STUDY THE PATTERN OF DERMATOSES AMONG WORKERS IN CASHEW NUT INDUSTRY AND TO ASSESS THE PROTECTIVE EFFICACY OF RUBBER FINGER GLOVE AS A BARRIER IN PATIENTS WITH DERMATOSES

Dissertation Submitted to

THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY

In fulfilment of the regulations for the award of the degree

M.D.

DERMATOLOGY, VENEREOLOGY AND LEPROLOGY

DEPARTMENT OF DERMATOLOGY, VENEREOLOGY AND LEPROLOGY

PSG INSTITUTE OF MEDICAL SCIENCE AND RESEARCH
THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY
CHENNAI, TAMILNADU

APRIL 2013

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GUIDE

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CERTIFICATE

This is to certify that the thesis entitled "**STUDY THE PATTERN OF DERMATOSES AMONG WORKERS IN CASHEW NUT INDUSTRY AND TO ASSESS THE PROTECTIVE EFFICACY OF RUBBER FINGER GLOVE AS A BARRIER IN PATIENTS WITH DERMATOSES**" is a bona fide work of **Dr. ANJANA MOHAN** done under the direct guidance and supervision of **Dr. C.R. SRINIVAS, MD** in the department of Dermatology, Venereology and Leprology, PSG Institute of Medical Sciences and Research, Coimbatore in fulfilment of the regulations of Dr.MGR Medical university for the award of MD degree in Dermatology, Venereology and Leprology

DR.C.R. SRINIVAS
Prof. & Head of Dept.
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DR.RAMALINGAM
Principal

DECLARATION

I hereby declare that this dissertation entitled "**STUDY THE PATTERN OF DERMATOSES AMONG WORKERS IN CASHEW NUT INDUSTRY AND TO ASSESS THE PROTECTIVE EFFICACY OF RUBBER FINGER GLOVE AS A BARRIER IN PATIENTS WITH DERMATOSES**" was prepared by me under the direct guidance and supervision of **Professor C.R. SRINIVAS, MD,** PSG Institute of Medical Sciences and Research, Coimbatore.

The dissertation is submitted to the Tamil Nadu Dr.MGR Medical University in fulfilment of the University regulation for the award of MD degree in Dermatology, Venereology and Leprology. This dissertation has not been submitted for the award of any other Degree or Diploma

DR.ANJANA MOHAN

CERTIFICATE BY THE GUIDE

This is to certify that the thesis entitled "**STUDY THE PATTERN OF DERMATOSES AMONG WORKERS IN CASHEW NUT INDUSTRY AND TO ASSESS THE PROTECTIVE EFFICACY OF RUBBER FINGER GLOVE AS A BARRIER IN PATIENTS WITH DERMATOSES**" is a bona fide work of **Dr. ANJANA MOHAN** done under my direct guidance and supervision in the department of Dermatology, Venereology and Leprology, PSG Institute of Medical Sciences and Research, Coimbatore in fulfilment of the regulations of Dr.MGR Medical University for the award of MD degree in Dermatology, Venereology and Leprology.

DR.C.R. SRINIVAS
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ANJANA MOHAN

INTRODUCTION

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Industrial dermatology is interesting because, it is often possible to see a large number of individuals manifesting a particular set of signs and symptoms which one hardly come across in the routine hospital practice.

Occupational Dermatitis can be defined as an inflammation of the skin caused by the working environment or by skin contact with a damaging substance or substances. It is a problem which in practice is faced by every dermatologist and is the basis of most occupational dermatoses.

Contact dermatitis may be irritant, allergic, immediate type contact reaction, non eczematous reactions, photocontact and phototoxic dermatitis.[1] Immediate type contact reaction and photoallergic photocontact dermatitis result from an interaction of allergen and ultraviolet radiation. This occurs when the interaction takes place on exposure to a particular dosage and on maintaining a particular contact period in the skin.

Allergic contact dermatitis results from sensitization to an allergen, which may be a hapten or an antigen. To clinically present with dermatitis, it requires more than one exposure.

Irritant contact dermatitis results from the toxic action of a substance coming in contact with the skin. No allergy is required for an irritant reaction to occur. It will occur on the first exposure provided it is applied in adequate concentration. The longer the substance remains on the skin, the more severe the reaction. Many chemicals, including industrial cleaning products and solvents, can cause this condition.

Another commonly encountered problem in dermatological practice is dermatitis to plants belonging to numerous families. It may be irritant, allergic, photoallergic, or phototoxic.

Plants causing these reactions are Alliceae, Alstroemeriaceae, Amaryllideaceae, Anacardiaceae, Araceae, Arliaeeae, Aspidiaceae, Bigononiaceae, Boraginaceae, Bromelieceae, Cactaceae, Canabideaceae, Capparidaceae, Compositae, Conniferae, Euphorbiaceae, Geraniaceae, Gesneriaceae, Gingkoaceae, Graminae, Hydrophyllaceae, Irridaceae, Labiatae, Lauraceae, Leauminosae, Liliaceae, Moraceae, Rubiaceae, Rutaceae, Rutaceae, Myrtaceae, Orchidaceae, Polygonaceae, Primulaceae, Ranunculaceae, Rosaceae, Saxifrogaceae, Sulanaceae, Umbilliferae, Urticaceae, Zingiberaceae and others.

Contact dermatitis to members of the family Anacardiaceae is common in India and abroad. They have the special feature of having more numerous potentially allergenic plants, than in any other family.[2]

Contact dermatitis to members of the family Anacardiaceae known to be allergenic are, Rhus Radicans or Poison Ivy, Rhus Diversiloba or Western Poison Oak, Rhus Querquifolia or Eastern Poison Oak, Rhus Vernix or Poison Sumac, Semecarpus Anacardium Or Marking Nut Tree, Smodingium Arguttum or Rainbow Leaf Tree, Toxicodendron Straitum or Rhus Straitum, Toxicodendron Verniciferum or Japanese Lacquer Tree.[2]

Cashew industry is a labour intensive industry requiring skill at almost every stage. India produces about 2 lakh tons of cashews per year, employing about 150,000 labourers in cashew factories. Kollam, situated in the southern parts of Kerala, alone exports 70% of processed kernels from the total quantity exported. The processing and selling of cashew kernels started more or less simultaneously at three centres in India in the 1920s. Kollam in Kerala, Mangalore in Karnataka and at Vettapalem in Andhra Pradesh.

Kerala employs more than 20,000 labourers in the cashew industry. About 13575 metric tons which is worth 60 crores INR of cashew shell oil are exported every year.[3] The women of the locality perform all the manual work. These women have nimble fingers and are quick, tidy, and intelligent enough to carry out all the work efficiently. To this day the women of the area retain these characteristics and cashew industry is the major employer of rural women. That is the reason why all the subjects included in this study are women.

The cashew industry is thus a major source of sustenance among the rural population in these areas. The major reason for this is the fact that the cashew industry is highly labour intensive at different stages of processing and grading.

During the shelling process these women come into contact with the noxious cashew nut shell oil liquid. This is implicated as the cause of dermatitis in this particular population. Contact dermatitis with cashew nut shell oil liquid and other components of cashew are well known.[4] This study demonstrates the efficacy of protective rubber gloves in preventing dermatitis in a cashew factory in Kollam, Kerala.

AIM

AIM

1. To study the pattern of occupational dermatoses among the workers in the cashew industry.

2. To assess the efficacy of rubber finger glove as a barrier among cashew nut workers.

3. To suggest protective measures to limit the severity of dermatitis.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Dermatitis or inflammation of the skin can result from various causes. These can be exogenous or endogenous. Among the exogenous causes of dermatitis, contact dermatitis is the most important and frequently encountered.

Dermatitis or eczema may be present clinically in acute, subacute or chronic forms and these may manifest with any of the following clinical features.

ACUTE ECZEMA	Erythema Oedema Oozing Crusting Vesiculation
SUBACUTE	Lichenification Scaling Erythema
CHRONIC	Lichenification with or without scaling.

Contact dermatitis may be classified as follows:[1]

1. Irritant contact dermatitis: a) Acute toxic irritant contact dermatitis b) Irritant reaction c) Cumulative irritant / insult contact dermatitis
2. Allergic contact dermatitis:
3. Phototoxic reactions Photoallergic reactions Light aggravated contact dermatitis
4. Immediate type contact reactions.
5. Non-eczematous reactions.

Hebra in 1868 showed that, an area of apparently normal skin when gently rubbed with croton oil , becomes red and feels hot and swells followed by slight scaling and desquamation. If no further applications are made, it returns to normalcy in 24 hours.

Jadahssohn, who is considered as the father of contact dermatitis, established the concept of allergic contact dermatitis in 1895 for the first time. He reported to the German Dermatological society of Grave, Austria in 1895 that iodoform applied to normal skin of 5 sensitised subjects reproduced the dermatitis.

Later in 1906, Von Pirquet suggested the term “Allergy” to designate an altered capacity to react, be it of the whole organism or only some of its tissues.

Landsteiner and Jacob in 1936 conducted the fundamental experiments which demonstrated that simple chemicals should combine with proteins to sensitize. These chemicals are of low molecular weight and form stable compounds by reacting with the free amino or sulphydryl groups of proteins.

Dermatitis to plants or phytodermatitis may result from members of various plant families such as Alliceae, Alstroemeriaceae, Amaryllideaceae, Anacardiaceae, Araceae, Arliaeeae, Aspidiaceae, Bigononiaceae, Boraginaceae, Bromelieceae, Cactaceae, Canabideaceae, Capparidaceae, Compositae, Conniferae, Euphorbiaceae, Combretaceae, Cupressaceae, Flindersiaceae, Geraniaceae, Gesneriaceae, Gingkoaceae, Graminae, Meliaceae, Saxifrigaceae Hydrophyllaceae, Irridaceae, Labiatae, Lauraceae, Epenaceae, Leauminosae, Liliaceae, Moraceae, Rubiaceae, Rutaceae, Rutaceae, Myrtaceae, Orchidaceae, Polygonaceae, Primulaceae, Ranunculaceae, Rosaceae, Saxifrogaceae, Sulanaceae, Umbilliferae, Urticaceae, Zingiberaceae.[5]

Among the plants causing Allergic contact dermatitis in India, Parthenium hysterophorus has been recognised as the most important.[6] Other plants causing contact dermatitis in India are Nerium Variabilis, Lantana Camara, Tradiscantia, Calotropis, Procera, Argemone Mexicana, Cyanodon Dactylon, Azadirachta Indica, Acacia Nilotica, Ficus Religiosa, Hibiscus, Arborvitae, Silver Oak, Bougainvillea.[7] Terminalia Chebula, Pennisetum Typhoides, Vignamungo, Tagetes, Arecta, Nicotiana Indicum, Red Snake Plant, Cajanus Cajan, Thuja, Jasmine, Cestrum Nocturnum, Carissa Carandus, Shorea Robusta, Cleome Viscose, Alysicarpus Monilifer, Euphorbia.[8] Nerium Odorum, Cassia Tora, Tamarindus Indica, Ageratum Conizoides.[9] Amaranthus Blithum, Alternamuera Triandra, Ipomoea Ramiciflora, Bryophyllum Calcinum, Lippia Nodiflora, Amaranthus Gangriticus (Red), Sonchus Oleraceus, Leucas Cephalotes, Ranunculus Scelernathus, Melilotus Parviflora, Cassia Occidentalis.[10] Albizia Lebbek, Panicum Antidotale, Salvadora Oleoides, Euphorbia Caducifolia, Lisirus Syndicus, Tephrosia Purpurea, Cyamopsis Tetragonolova.[11]

Among the plants causing allergic contact dermatitis in India, air borne allergen of Parthenium hysterophorus a composite weed, has been recognised as the most important, to cause photo contact dermatitis apart from allergic contact dermatitis. This explains the predilection for

exposed areas.[12] Later during the course of the disease unexposed sites may get exposed. This plant is variously known as Congress grass, carrot weed, white top and bastard fever few.

In 1956, Parthenium is accidentally introduced in India through imported food grains. This plant grows on wastelands. It also grow along canals, forest areas, plantations, and areas with dense vegetations. Typically it presents as airborne contact dermatitis. Later it generalises to produce erythroderma like picture. It commonly involves the upper eyelids and nasolabial fold, sparing the retroauricular area. Lichenification is a common feature.

The only effective treatment is the correct identification of the allergen, and to remove the patient from the area in which the weed is growing. The most important sensitizing chemical of Parthenium is Sequisterpene Lactone, a Parthenolide. Parthenium dermatitis is rare in women and does not affect children.

Mitchell suggested a system of classification for phyto dermatitis and is as follows.[2]

1. Irritant phytodermatitis	a)Chemical : Exemplified by members of the species Euphorbiaceae, Cruciferae, Ranunculaceae and Anacardiaceae b) Physical : Due to mechanical injury resulting from Trichomes, Spicules, Coarse hairs, Raphides or Spines c) Physical and chemical : Examples are stinging hairs with histamine and acetylcholine in nettles (Urticaceae family) and trichomes with an endopeptidase in cow hage (Mucuna Pruriens).
2.Allergiccontact phytodermatitis	a) Immediate hypersensitivity: Contact urticaria eg: Uren Urticaria, Cactus, Marine plants, Rhus species. b) Delayed contact hypersensitivity. c) Physical and allergic reaction in concert eg: reactions to glochids of prickly pear (Opuntia).
3. Phytophoto dermatitis	Results from fluorocoumarins and long wave UV light. The important families are Umbilliferae, Rutaceae, Moraceae.
4.Pseudophytophoto dermatitis	i) Parasitophytophoto dermatitis due to parasitic fungi on plants. ii) Epiphyto dermatitis : Lichens and liverworts growing on trees. iii) Parasitophytophoto dermatitis: Celery produces furocoumarins only when parasitized by the fungus Sclerotina. iv) Pseudophyto dermatitis due to contamination eg: Pesticides, fungicides, dyes, mites.

The members of family Anacardiaceae causing allergic contact dermatitis are:

1.Toxicodendron species:

A	Rhus Toxicodendron/ Rhusradocans Poison Ivy/ Poison Vine/Poison Creeper/ Mark Wood
B	Toxicodendron Diversilobium, Synonymous With Rhus Toxicodendrone, Rhus Diversiloba, Western Poison Oak
C	Toxicodendron Querquifolium, Rhus Querquifolium or Eastern Poison Oak.
D	Toxicodendron Vernix, Rhus Vernix, Poison Dog Wood, Elder or Sumac

2.Anacardium Occidentale or Cashew Nut.

3. Gluta Renghas.

4. Mangifera Indica or Mango.

5.Rhussuccedanea, Stag Horn Tree or Antler Tree.

6.Rhus Typhinia or Velvet Sumac.

7.Semicarpus Anacardium or Indian Marking Nut.

8.Smodingium Argutum, Rainbow Leaf Tree, Um-Tovens or Tovena.

9.Toxicodendron Striatum or Rhus Striata.

10.Toxicodendron Vernalciferun, Rhus Vernicifera or Japanese Tree.

Holigarna Ferruginea March is one other important member of family Anacardiaceae, which could be a common cause of allergic eczematous contact dermatitis in South India. In sensitised individuals, this cause an acute eczematous eruption over exposed areas from six hours to two days following contact with the leaves, nut, wood or bark of the tree. It has a high sensitising index as proved by rat experiments and the allergen is 3-hupta-deca-dienyl catechol. Gross sensitivity to other Anacardiaceae antigens has been demonstrated.[13,14,15,16]

The family anacardiaceae has the largest number of members causing contact dermatitis as compared to any other family.

Once sensitised to cashew nuts, individuals are at a risk of developing food allergy and other hypersensitivity reactions.[17]

Initially, Cashew nut allergy was thought to be very rare. Recent studies reveal that 1 out of 1,218 in a paediatric population on the Isle of Wight, UK developed cashew nut allergy. Although rare, when it occurs it is of very severe intensity.[18]

Initially cashew nut was regarded as a novel food. Now due to its increasing in popularity as a snack, it is regarded as an "emerging" allergen.[19] As a result of this, hypersensitivity reactions are expected to increase.[20]

As recent consumption of cashew nuts have increased in Asian cuisine, the associated allergies are more frequent than they were encountered formerly.[21]

Cashew nut allergy has been implicated as the second most commonly reported nut allergy in the United States.[22]

Cashew nuts contain oleoresins besides the protein allergens. Apart from contact dermatitis, oleoresin causes gastrointestinal, systemic and allergic manifestations.

A retrospective analysis of 213 Australian children with Peanut or tree nut allergy revealed that anaphylaxis to Cashew nut was more common than to Peanut (74.1% vs 30.5%).[23]

Though most components of cashew nuts are allergens, cashew nut shell liquid, cashew apple and the nut can act as irritants.

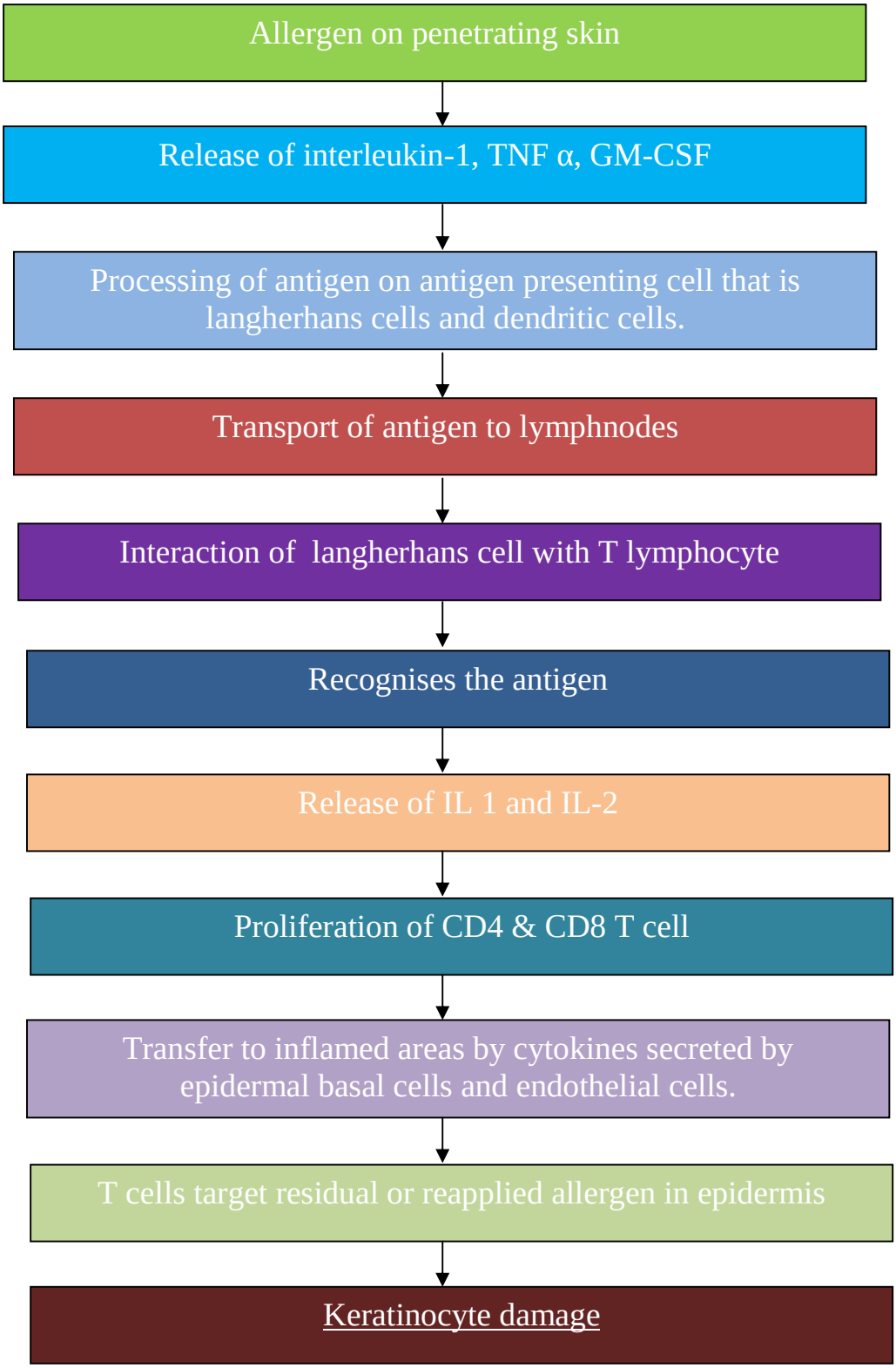
Plants most commonly implicated in causing chemical irritant dermatitis are mentioned below.[24]

Family	**Common Name**	**Irritant chemical**
Agavaceae	Century Plant	Calcium Oxalate Saponins
Alliaceae	Garlic	Thiocyanates (Bulbs)
Amaryllidaceae	Daffodil	Calcium Oxlate (Stem, Bulb)
Araceae	Philodendron Dumb Cane	Calcium Oxalate (Leaves & Fruit)
Brassicaceae	Black Mustard Radish	Thiocyanates (All Parts)
Bromeliaceae	Pineapple	Bromelin (Stem>Fruit) Calcium Oxalate (All Parts)
Euphorbiaceae	Florists Croton	Phorbol Esters
Lilaceae	Hyacinth	Calcium Oxalate (Bulbs)
Polygonaceae	Rhubarb	Calcium Oxalate (Leaves)
Ranunculaceae	Buttercups Marsh-Mariegold	Protoanemonin (freshly damaged plant parts)
Solanceae	Hot Pepper	Capsaicin(no dermatitis; only erythema, edema, burning)

For better understanding of the contact dermatitis, Differences between Allergic contact dermatitis and Irritant contact dermatitis are tabulated as below.

Allergic contact dermatitis	Irritant contact dermatitis
Immunologically mediated type 4 hypersensitivity reaction	Non immunological inflammatory response to an antigen.
Occurs in a sensitized individual who is previously exposed to the antigen	Can affect anyone on first exposure.
Exposure to very low concentration of causative agent can reproduce the dermatitis	Occurs at high concentration. Dependent on skin barrier function
Lesions are generalized.	Lesions confined to site of exposure
Evolution is relatively slower(days)	Rapid evolution (hours)
In patch test, the borders are poorly defined and reaction may occur also at distant site.	Sharply well defined border. Reaction occurs at the site where the antigen is in contact with skin.
On removal of the patch, healing is slow.	Quick healing of lesions once the patch is removed.

The pathogenesis of contact sensitization is well understood and is as follows:



Contact dermatitis is differentiated from other types of dermatitis on the basis of clinical findings, knowledge of exposure to potential allergens or irritants, and diagnostic patch testing.

The histopathology of contact dermatitis show overlap with other forms of dermatitis. Hence usually histopathological analysis is not useful in differentiating this from the various forms of dermatitis. Diagnosis is made based on clinical presentation after exclusion of contact allergy.

Cashew nut is a member of family Anacardiaceae which is known to produce dermatitis. The tree is a native of Brazil, but is also grown in the other parts of the world including India, Mozambique, Tanzania, Kenya. The buds grow on terminal panicles. The flowers change their colour from pale green to reddish as they develop. Flowers have 5 slender pointed petals. The cashew tree flowers once a year between August and October. Pollination occurs mainly by insects.

Pear shaped accessory fruit of false fruit is called the cashew apple. This is yellow or red, soft and juicy and rich in vitamin C. The cashew apple is rich in nutrients and contains five times more vitamin C than an orange. The kidney shaped nut is botanically defined as a seed that grows at the end of cashew apple.(fig.1)

The cashew nut shell (Pericarp) has 3 layers which includes:

- The outer Exocarp
- Middle Mesocarp
- Inner Endocarp

Mesocarp is filled with an oily fluid containing substances that are themselves allergens such as Cardol, Cardanol, 2-Methyl Cardol And Anacardic Acid. The shell oil is an amber coloured fluid which has an immediate vesicant reaction because of its high concentration of phenols. Cashew oil must be removed before the nut is processed for consumption.

Anacardic Acid in shell oil is present only in small amounts. This is due to the fact that most of it gets decarboxylated during the extraction process. The heating process causes the pericarp to burst, releasing the cashew nut liquid and at the same time decarboxylating the anacardic acid converting it into less allergenic cardanols. The resulting monophenol is a very useful industrial raw material for the manufacturing of lacquers and varnishes. The concentration of phenols in cashew nut shell and bark is so high that contact with them, causes immediate vesicant reactions.

The commercial cashew nut shell liquid contains:

Major constituents: Monophenyl and Dihydric Phenol

Minor constituents: Six Alkyl Salicylic Acid (anacardic acid).

Cashew nut shell oil is amber coloured, poisonous, viscous oil obtained from the by product shells of cashew nut by extraction. Different methods to extract cashew shell oil include steam heating, drum roasting , Gas liquid chromatographic methods. With the use of gas liquid chromatographic methods, the component phenols in the technical cashew nut shell liquid have been determined.

The heat extracted liquids, do not contain more than 16%. The liquids obtained by pressure extraction or solvent extraction are known to contain up to 70% of anacardic acid. The other processes used are mainly hot oil and roasting in which cashew nut shell oil oozes out from the shell.

Cashew nut shell liquid contains:

82 +/- 1.05% Anacardic Acid (Carbopenta-Dica-Dienyl-Phenol)

13.8 + 0.79% Cardol (Dicarboxy-Pentadica-Dienylbenzene)

2.6 + 0.16% 2-Methyl Cardol

1.6 + 0.17% Cardanol.[25]

The resorcinol cardol is both an irritant and an allergen with side chains similar to that of poison ivy and poison oak. Early oral exposure to resorcinols such as cardol appears to protect against contact dermatitis to catechols (present in poison ivy). Early cutaneous exposure to catechols predisposes to an allergic reaction to resorcinols.

Cashew nut shell oil has 12 allergens. These are combinations of three basic structures with either unsaturated mono, di or tri olefinic pentadecyl side chains. In the oil, 10% is cardol and 70% Cardonol and 30% anacardic acid. Most of the anacardic acid is converted to cardonol in the heating process.[5]

Properties of cashew nut shell oil:

Properties at 320ºC	**Value**
pH	5.79
Specific gravity(g/cm^3)	0.95
Viscosity	58.9
Refractive index	1.48
Total dissolved solids heated at 90ºC	1.53
Molecular weight	5030.74

The traditional method of extracting cashew nut shell oil is by roasting of the nuts over an open fire. This removes oil by charring and degradation.

Cashew testa is the outer skin of cashew kernel which contains about 25% of tannin material and 11% of non tannins. The tannins consist of De-Catechin, Gallic Acid and Leucocyanidin, a significant tannin precursor, while the non tannin consists of Cunic and Caffeic Acid.25

The roasted Indian cashew has a characteristic flavour and colour unmatched by any machine–processed produce, which help it to retain the discerning clients the world over.

Anacardium Occidentale or cashew nut has many uses.

- The cashew kernel or nut is used as a snack and in many bakery items.
- The cashew apple is a delicious fruit and is used for making sweets, ice creams, confectionary items and to brew fenny.
- The cashew apple has 5 times more vitamin c than in orange.
- The cashew gum obtained from the tree is used for tanning leather and glues.
- The cashew nut shell liquid has various industrial applications (for making resins, varnishes, paints, printers ink, type writer rolls, pesticides, lubricants and electric insulations).

- Previously, cashew shell oil was used to treat dental abscess due to their lethality to wide range of gram positive bacteria.
- The wood is used for making crates and boats, or as a fuel.
- The cashew oil is used in phenol formaldehyde resin synthesis, cold setting cement, printer's ink, insulating varnish, floor tiles, brake linings, type writer rolls and paints. All of which are sources of allergen.[25,26]
- The nut and wood are used to make voodoo dolls and swizzle sticks.

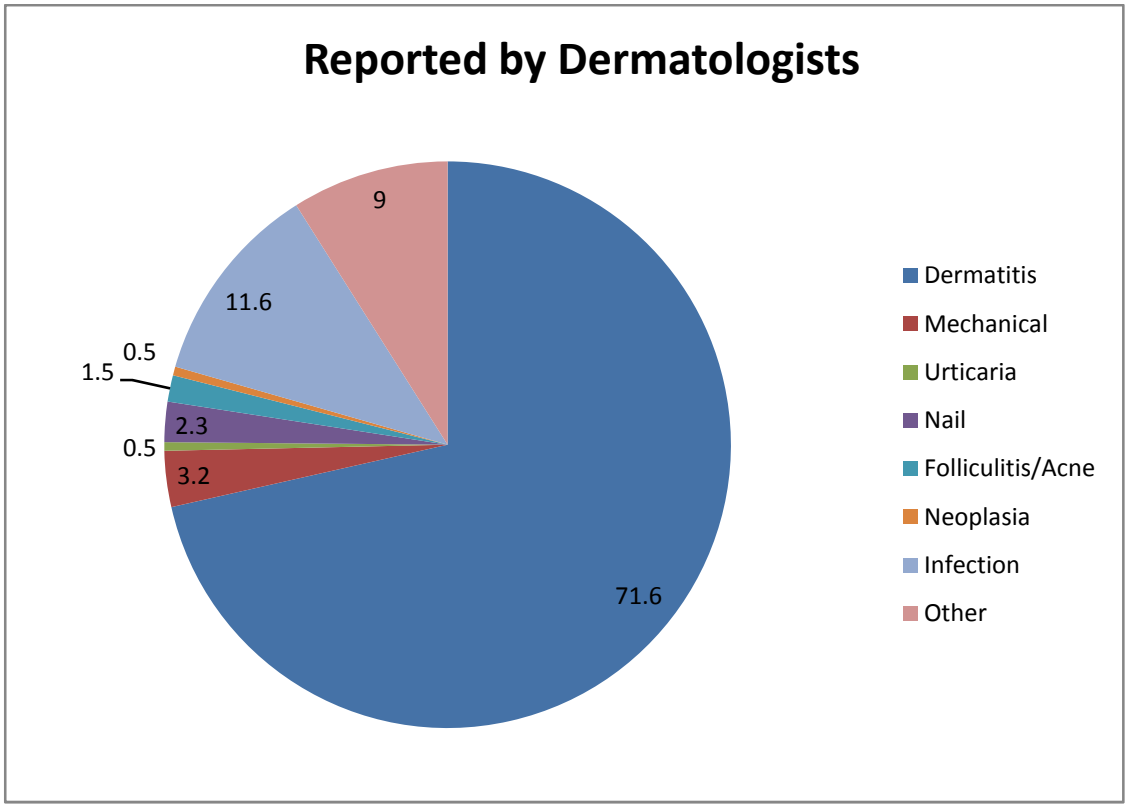
It is to be noted that the cashew wood exudes a yellow gum that can cause vesicant reactions. Apart from the shell oil and the wood, the tree bark produces thick resinous latex that turns black on contact air and may result in blistering reactions on contact.

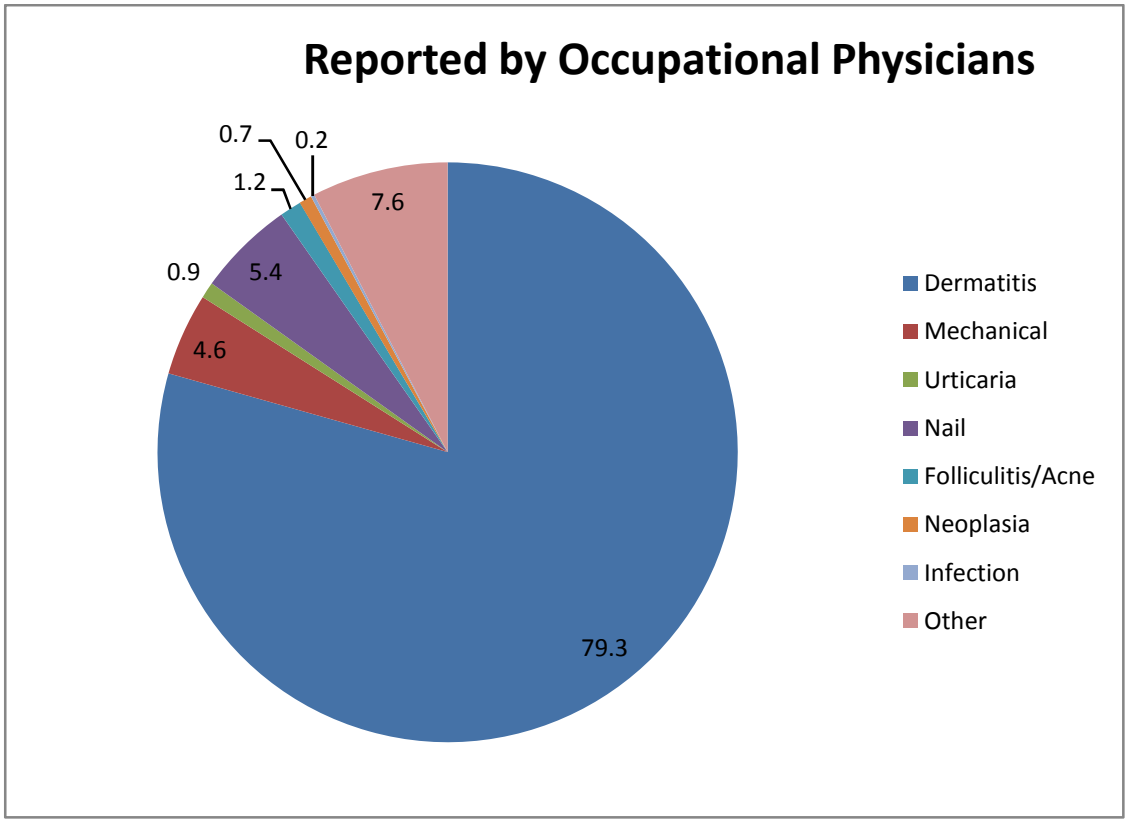
A curious outbreak of facial dermatitis in children has been reported to toys made of cashew nut shells.[5] Occupational dermatoses comprise any skin disease which results following occupational exposure and can induce various pathological processes.

Clinically occupational dermatoses can be classified as follows.[27]

Contact dermatitis	Irritant • Chemically induced • Photo induced • mechanical Allergic
Chemical burn	
Contact urticaria	
Cancer	• Sunlight induced/ UV induced • Ionizing radiation induced • Chemically induced
Follicular disease	• Acne • Chloracne
Autoimmune connective tissue disease	• Scleroderma like • Vibration induced
Pigmentary disorders	• Hypopigmentation • Hyperpigmentation
Foreign body reactions	
Infection	• Viral • Bacterial • Fungal

Relative frequency of occupational dermatoses[27]





Various patterns of dermatitis have been described among those who come in contact with cashew products.

- Ulcer formation
- Roughness
- Cracking
- Irritation of palmar and dorsal surfaces of hands from the resinous oil and shell among cashew harvesters
- Urticarial rash
- Contact dermatitis on the hands and around the mouth
- Stomatitis
- Gastroenteritis
- Perianal dermatitis among those who roast , peel and eat cashew nuts.[16,28]

Residual resin is removed from the kernel after extraction of cashew nut shell oil from the hull. This process may be modified to obtain raw looking nuts which are sometimes commercially preferred. Residual amounts of allergen may be present after this processing technique.

When five patients, sensitive to poison ivy ate large numbers of allergen contaminated nuts supplied by a health store, all of them developed wide spread dermatitis. This demonstrated combined contact allergy and a systemic drug type of reaction akin to some responses to penicillin.[29]

Cross sensitivity exists between Mango stem sap, Semicarpus Anacardium, Phenolic extracts of cashew shell oil, Gluta Renghas, Poison Ivy, Gingkobiloba fruit pulp and Toxicodendron Verniciferum.[28]

In 1982, an outbreak of dermatitis occurred in Pennsylvania among 54 people who had consumed cashews from a single source. These individuals manifested with erythematous pruritic maculopapular rash on the extremities, axilla, head, trunk, groin and buttocks with accentuation of the rash in flexural areas. Perianal itching, blistering in the mouth, desquamation of hands and feet were also noted in those patients. The median duration of onset being two days and that of illness being seven days. The implicated antigen was determined by high resolution electron ionization and mass spectrum analysis to be penta decyl resorcinol (C21 H36 O2 H+). This compound is related to cardol with the exception that it bears a side chain.[28]

The relative allergenicity of the oleo resins and the individual chemicals is not known precisely. Gas chromatography is a useful guide is in assessing the allergenicity of oleo resins.

Oleo resins from Toxicodendron Radicans, Toxicodendron Diversilobum and Toxicodendron Vernix are equipotent. Oleo resin from Toxicodendron Verneciferum is the most reactive and that from Anacardium Occidentale is unstable. This is probably due to a problem in antigen preparation.[5]

Chemical structure influences allergenicity. Two hydroxyl groups on the benzene ring are optimal. The most potent Toxicodendron antigen is the diolefin.

The cashew factory surveyed by us was located at Kollam nearly 50kms from the capital Trivandrum. The shelling section employs 75 workers; the roasting section employs 7 workers, the peeling and grading section 135 & 65 workers. It receives cashew nuts plucked from the cashew nut trees growing in the adjoining villages of Kerala, Karnataka, Tamilnadu, and also from Africa and south East Asian countries. The cashews are sundried before sending to the factory and are encased in their shells. (fig.2)

In the factory, the cashew nuts are first heat roasted in hot large chambers for 20-25 minutes, and then cooled in the air overnight.(fig.3) This process makes the cashew kernels detach themselves from the shell.

They are then taken to the cutting section where the shells are broken open with the help of a rod to free the cotyledons. This is done on a manual basis. The workers do their work sitting on the floor. This section employs females only.

One of the girls places the cashew nut upside down first on masonry or a wooden block or a brick. Burnt down wood ash is sprinkled over the cashew nuts for securing better grip. It is then crushed with a mallet with a single stroke on the upper side of the cashew, using a wooden stick. (Fig 4) Then the position of cashew is reversed with the concave portion pointing upwards. One more stroke is given on the diagonally opposite portion. With these two strokes the cashew shell is broken longitudinally along the centre. Additional small blows are given in case required that is when the cashew shell is not properly split.

With the help of both hands, the cashew shell is fully separated and the kernel inside s extracted. The hands and feet of these girls are exposed to shell oil. They routinely apply coconut oil on their hands and feet as a

protective agent. It is during this time that the workers come in contact with the shell oil leading to dermatitis.

The shells are discarded in a heap at the cutters feet from where they are picked up in baskets and carried to the shell oil extracting section.

The shelled cashew cotyledons, along with the intact endocarp are then taken to the roasting section where they are roasted in a walk in oven on stacked trays at 70-80 degrees centigrade for 10-11 hrs. (Fig 5)

The roasting section employs two people, both men. The cashews are cooled and then taken to the peeling section where the endocarp is hand peeled. (Fig 6) The peeled cashew kernels are then classified into different quality grades depending upon whether these are intact whole cashew kernels or these are broken into different sized pieces.

The cashews are then taken to a packing machine where they are dusted, packed and sealed for storage and marketing.(fig.7) Two types of packing methods are followed in the cashew industry. One is tin filling and the other being flexy bag packing.

In case of tin filling, the cashews are filled first into the tins of 25 Lbs and vacuumised to -760 mm of Hg. Then it is flushed back with Co_2

to atmospheric pressure and sealed. The pressure inside the tin is as same as atmospheric pressure that is 0 mm of Hg.

In case of flexy bag packing, the cashew nuts are first filled in the multilayered polythene packets of 25 Lbs or 50 Lbs as the case may be. The filled packet is first vacuumised at -650 to -700 mm of Hg. It is then flushed back with nitrogen to -400 to -350 levels. It then undergoes one more flushing with Co_2 at -200 to -250 mm of Hg and sealed.

In case of tin packing the pressure inside is same as the atmospheric pressure. Whereas in case of flexy packing, an end vacuum of -200 to -250 is maintained.

The shells of cashew nuts are taken into another section where the shells are crushed between rollers and the liberated cashew nut oil is collected. It is then tinned and marketed for various industrial purposes.

The residue, the shell cakes are burnt as fuel, while the crude oil is heated at 450ºC for 3-4hrs to take away the moisture from the cashew nut shell oil.

As the work is fully automated, workers in the dusting and packing section do not come in contact with the cashew oil at all. Hence the risk to develop dermatitis is minimal. The workers in the shelling section are

more exposed to the irritant cashew shell oil. Hence the dermatitis is more severe among this group of workers.

An open patch test which was performed with the cashew nut shell oil in 37 workers produced the cauterization type of reaction in 32 workers. This in turn was surrounded by papule- vesicular lesions. Standard occluded patch tests was performed with 10%, 1.0% and 0.1% concentration of cashew shell oil in polyethylene glycol showed positive reaction in 6 workers. Cashew nut pericarp and the cashew nut kernel were crushed and applied and produced papulo-vesicular reactions. Patch tests with 1% and 0.1% concentrations of shell oil were negative in all workers. Patch tests with castor oil and polyethylene glycol (control) were negative.[30]

Factors affecting irritancy potential of substances on human skin are:

- Exogenous factors
- Endogenous factors
- Co-factors

The exogenous factors implicated in the irritancy potential of substances on human skin are tabulated below.[31, 32]

Chemical characteristics	**Penetration characteristics**
Molecular structure	Vehicle
PH	Solubility
Pk_a (dissociation constant)	Duration of contact
Hydrophobicity (log P)	Type of contact
Inherent toxiciy	
Concentration/ dose	

The endogenous capable of producing irritancy potential are listed as below:[31,32]

1.Individual susceptibility	• Atopy • Race/skin/color/phototype • Age • Hormonal • Barrier function • Repair capacity • Eczema elsewhere • Other skin diseases
2.Site of exposure	

Co-factors that are responsible for the irritancy potential on the human skin are:[31,32]

1. Mechanical
2. Thermal
3. Climatic

Application of a protective substance to exposed skin before exposure to the antigen is a common method in the prevention of dermatitis[30]. This approach has been tried for over 20 years using substances such as exchange resins, tyrosinase, chloramide, sodiumperborate, zirconium salts and alkaline peroxide[33.]

Bgornberg postulated that a plastic film of acrylic polymer protects against chemicals such as potassium hydroxide, phenol, detergents, acids and alcohol. [34]

Irritants penetrate skin and result in the alteration or damage of the skin cells. Dermatitis occurs when the ability of skin to defence or repair the damage is exhausted. In almost all individuals, strong irritant induce clinical reaction.

The response maybe physiological in less potent irritants that is it either occur only in most susceptible individuals or in situations where there is multiple contact with the irritant.[35]

After World War 2, the idea of using protective cream as a barrier became popular. As such this method has been in existence for fifty years.[36] Barrier creams have been studied to prevent the occurrence of dermatitis. They help protect against irritants, but they do not successfully prevent allergic reaction.[37] however it is tedious, expensive and requires repeated application.

In such cases, gloves may be beneficial. With organic solvents and chemicals, the choice of glove material may vary.[38]

Berardinelli in 1988 recommended glove materials for chemical protection which is tabulated as follows.[38]

Chemicals	Glove Materials					
	Nitrile	Butyl	Neoprene	Fluorocarbon	PVC	PVA
Aliphatic hydrocarbons	+			+		+
Aromatic hydrocarbons	+			+		+
Halogenated hydrocarbons			+		+	
Aldehydes, Amines & Amides	+					
Esters			+			+
Alkalis		+		+		+
Organic acids	+	+	+			
Inorganic acids	+		+		+	

PVC: Poly Vinyl Chloride PVA: Poly Vinyl Alcohol

The protective effect of different glove materials against chemicals is dependent of the following factors.[39]

1. Thickness

   Breakthrough time increases as the thickness of the glove material increases but in an uneven fashion. Breakthrough is defined as the time required for the chemical to visibly degrade gloves.

2. Material composition

   The gloves manufactured by different manufacturers have different resistance capacity due to variation in polymer formulation. The quality and protective effect of gloves of the same material can differ due to manufacturing processes, additives and quality control.

   Index based on breakthrough times determined during constant contact with the test chemicals described in European standard as described in EN 374-3 is shown below.[39]

Protection index	Measured breakthrough time (min)
Class 1	>10
Class 2	>30
Class 3	>60
Class 4	>120
Class 5	>240
Class 6	>480

The use of rubber finger gloves as a barrier avoids the disadvantages of repeated application, sensitization and poor worker tolerance as compared to use of barrier cream. With the gloved hand, chemicals must first penetrate the glove membrane, then an aqueous sweat layer, and finally the stratum corneum. The glove and skin probably represent the two main barriers to permeation.

In use, a glove worn on a human hand is in contact with sweat and skin which has a limited capacity to absorb chemicals.

MATERIALS AND METHODS

MATERIALS AND METHODS

Industrial dermatology is interesting because, it is often possible to see a large number of individuals manifesting a particular set of signs and symptoms which one hardly come across in the routine hospital practice.

Occupational Dermatitis can be defined as an inflammation of the skin caused by the working environment or by skin contact with a damaging substance or substances. It is a problem which in practice is faced by every dermatologist and is the basis of most occupational dermatoses.

Contact dermatitis may be irritant, allergic, immediate type contact reaction, non eczematous reactions, photocontact and phototoxic dermatitis.[1] Immediate type contact reaction and photoallergic photo contact dermatitis result from an interaction of allergen and ultraviolet radiation. This occurs when the interaction takes place on exposure to a particular dosage and on maintaining a particular contact period in the skin.

Allergic contact dermatitis results from sensitization to an allergen, which may be a hapten or an antigen. To clinically present with dermatitis, it requires more than one exposure.

Irritant contact dermatitis results from the toxic action of a substance coming in contact with the skin. No allergy is required for an irritant reaction to occur. It will occur on the first exposure provided it is applied in adequate concentration. The longer the substance remains on the skin, the more severe the reaction. Many chemicals, including industrial cleaning products and solvents, can cause this condition.

Another commonly encountered problem in dermatological practice is dermatitis to plants belonging to numerous families. It may be irritant, allergic, photoallergic or phototoxic.

Contact dermatitis to members of the family Anacardiaceae is common in India and abroad. They have the special feature of having more numerous potentially allergenic plants, than in any other family.[2]

Cashew industry is a labour intensive industry requiring skill at almost every stage. India produces about 2 lakh tons of cashews per year, employing about 150,000 labourers in cashew factories. Kollam, situated in the southern parts of Kerala, exports 70% of processed kernels from the total quantity exported. The processing and selling of cashew kernels started more or less simultaneously at three centres in India in the 1920s. Kollam in Kerala, Mangalore in Karnataka and at Vettapalem in Andhra Pradesh.

Kerala employs more than 20,000 labourers in the cashew industry. About 13575 metric tons which is worth 60 Crores INR of cashew shell oil are exported every year.[3] The women of the locality perform all the manual work. These women have nimble fingers and are quick, tidy, and intelligent enough to carry out all the work efficiently. To this day the women of the area retain these characteristics and cashew industry is the major employer of rural women. That is the reason why all the subjects included in this study are women.

The cashew industry is thus a major source of sustenance among the rural population in these areas. The major reason for this is the fact that the cashew industry is highly labour intensive at different stages of processing and grading.

During the shelling process these women come into contact with the noxious cashew nut shell oil liquid. This is implicated as the cause of dermatitis in this particular population. Contact dermatitis with cashew nut shell oil liquid and other components of cashew are well known.[4]

This study demonstrates the efficacy of protective rubber gloves in preventing dermatitis in a cashew factory in Kollam, Kerala.

To conduct this prospective observational study, two visits were made to the cashew factory in Kollam, Kerala. During the first visit the severity of dermatitis was assessed. During that visit, it was brought to the notice of one of the investigators that in Southern parts of Kerala, the workers routinely used rubber finger gloves which is available in the local market to prevent damage to the skin.

The efficacy of glove material to withstand the corrosive effect of CSOL (cashew nut shell oil liquid) was assessed during the second visit. Data collection was completed in a period of one month.

Few gloves used by the workers were obtained and examined. These gloves were available in various colours and can be worn on each finger separately. It is to be noted that this particular type of rubber finger glove is available only in one size. Similar finger gloves are used by the local people while cutting vegetables. (fig.8)

A specific technique is followed to wear the glove whereby it is rolled into a compact size before application and then smoothed over the fingers.

In a study done previously, the authors have already reported the severity of dermatoses among the cashew nut workers.[30] Ph of cashew nut shell oil was measured by dipping litmus paper in the CSOL. The

colour of litmus paper changed to red indicating acidic nature of its constituents. 2 ml of CSOL was poured inside the finger gloves and hung. The outer surface was examined at 8^{th} hour intervals. At the end of 48 hours there was no breakthrough.

Breakthrough is defined as the time required for CSOL to visibly degrade gloves. The contents were emptied. The gloves were cleaned under running tap water in room temperature. It was then stretched to assess its tendency to tear and was compared to that of an unused normal glove.

The effort (amount of force) required to stretch the glove was less as compared to that of normal glove. Colour change (fading) of the glove was also noted.(fig.9) No cracking or loss of tear resistance was appreciated.

We randomly selected 15 workers who were using the gloves and 15 workers who were not using the gloves. Using the glove is defined as those who use finger gloves routinely during work hours.

Exclusion criteria followed is tabulated as below:

Irregular workers
Who used the gloves irregularly
Interrupted manner
Workers on systemic and topical steroids / immunosuppressant
Newly employed workers
Evidence of other dermatological disease such as psoriasis, eczema.
Pregnant and Lactating women.

Photographs for the assessment of severity of dermatitis by the blinded observer were taken using NIKON D3000 camera under same lighting and maintaining the same distance and position/angle after obtaining informed consent in their regional language Malayalam. Clearance from the local ethical committee was granted to conduct this study.

Severity of dermatitis (based on the severity grading scale) as mentioned above was recorded on the palmar aspect of individual fingers on both hands. The photographs were graded independently by a blinded observer.(table1) The blinded observer is a professionally qualified dermatologist with no prior information or involvement in this study.

Data obtained were subjected to statistical analysis using SPSS 19. Mean SD were calculated and “t” test was used to compare the mean values.

P value < 0.05 was considered to be statistically significant.

For better understanding, we have analysed and compared the severity of dermatitis over each finger separately in both the groups.

RESULTS

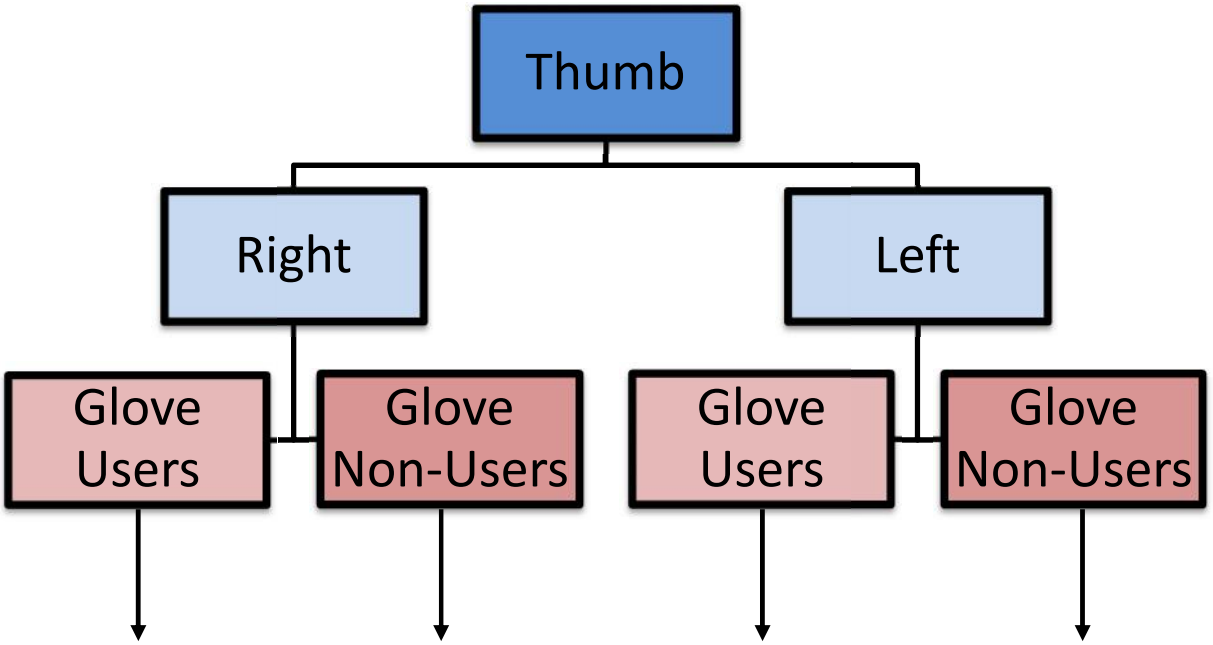
RESULTS

Severity of dermatitis among the users and non users were graded on individual fingers of right and left hand separately. We compared the severity of dermatitis on each finger to the corresponding finger on the other hand. The pattern of dermatitis was graded and recorded. (Table 2, 3)

For better understanding, the changes observed have been illustrated in a flowchart for each finger separately, where X = Grading of dermatitis as per the severity grading scale; Y = number of workers who had the dermatitis of the mentioned grade. Then pattern of dermatitis on each finger was recorded and subjected to statistical analysis.

Data obtained were subjected to statistical analysis using SPSS 19. Mean SD were calculated and “t” test was used to compare the mean values. p value <0.05 was considered to be statistically significant.

Thumb:



X	0	1	2	3	4
Y	1	0	13	1	0

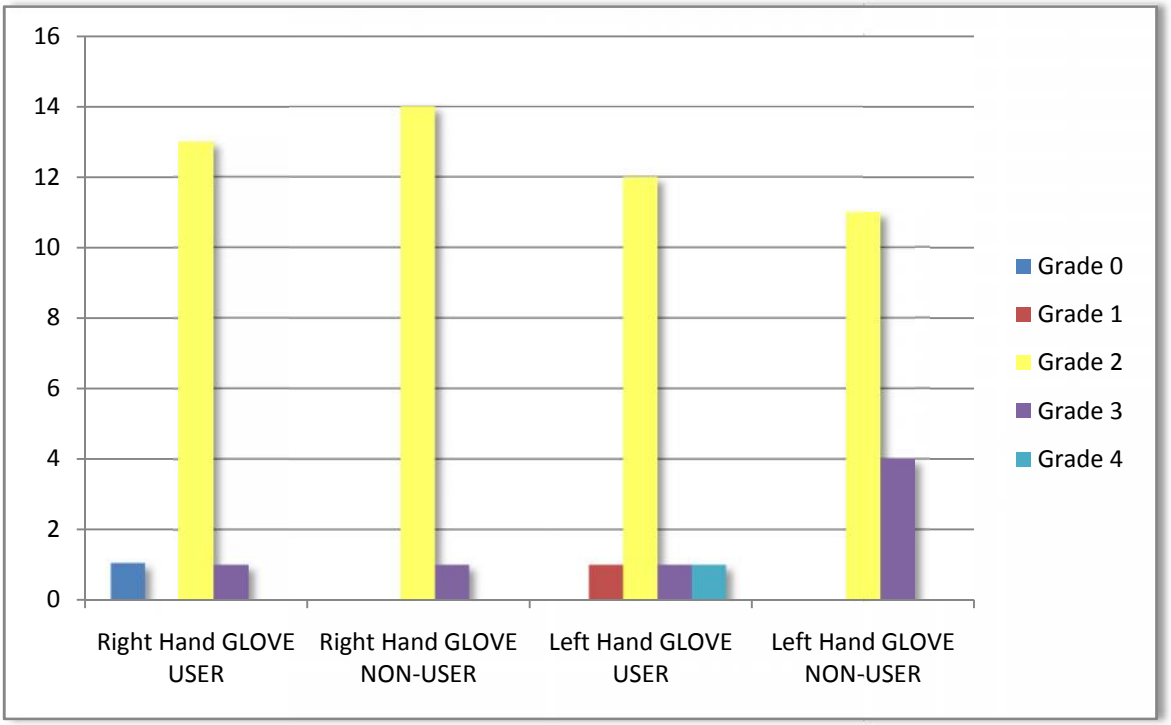
X	0	1	2	3	4
y	0	0	14	1	0

X	0	1	2	3	4
y	0	1	12	1	1

X	0	1	2	3	4
Y	0	0	11	4	0

X: Grade

Y: No. of workers



Bar Chart showing the above mentioned values in Thumb

13 workers showed grade 2 severity in right thumb among glove users whereas 14 in the non glove user group exhibited grade 2 dermatitis. In the left thumb among glove users, twelve showed grade 2 dermatitis. In the left thumb, eleven showed grade 2 dermatitis.

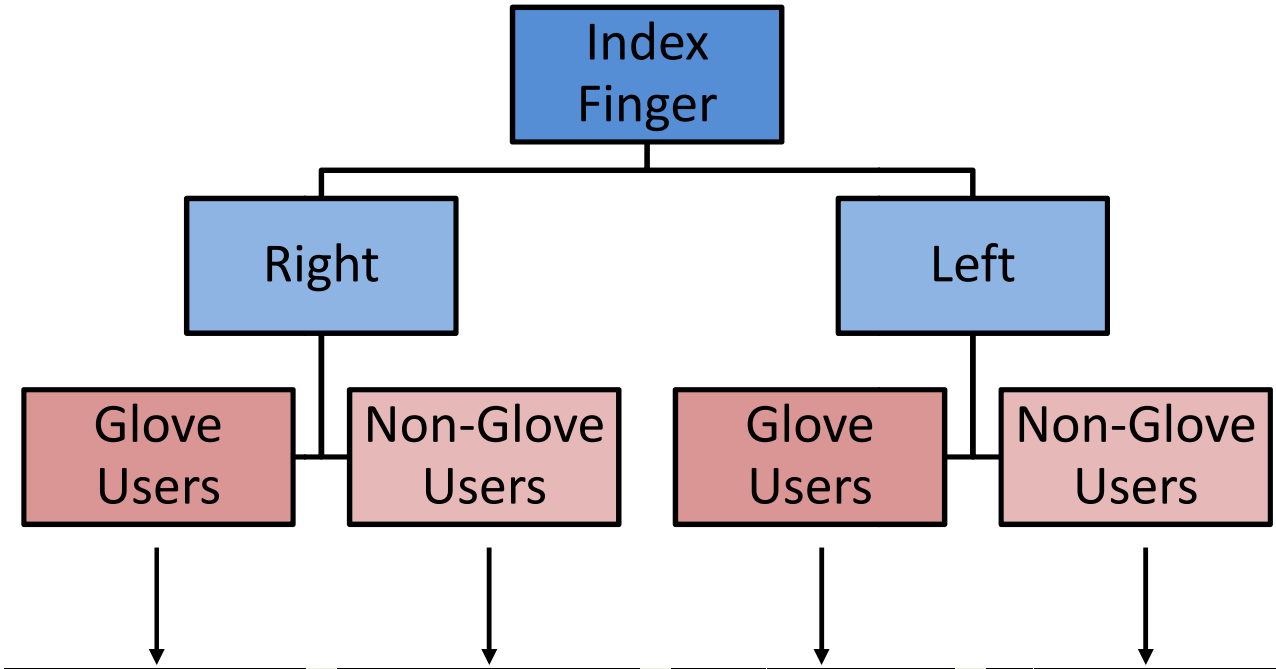
In the non user group, four workers had dermatitis of grade 3 severity whereas only one worker showed grade 3 severity among the glove users.

Statistical Analysis

FINGERS	Test (T = 1) Users		Control (C=0) Non Users		t	p
	Mean	SD	Mean	SD		
Right Thumb	1.93	0.59	2.06	0.25	0.79	0.431
Left Thumb	2.13	0.63	2.25	0.44	0.59	0.559

The mean value denoting degree of dermatitis on each finger was calculated separately among the glove users and glove non users. Results obtained showed no statistically significant difference between the aforementioned groups.

Index Finger:



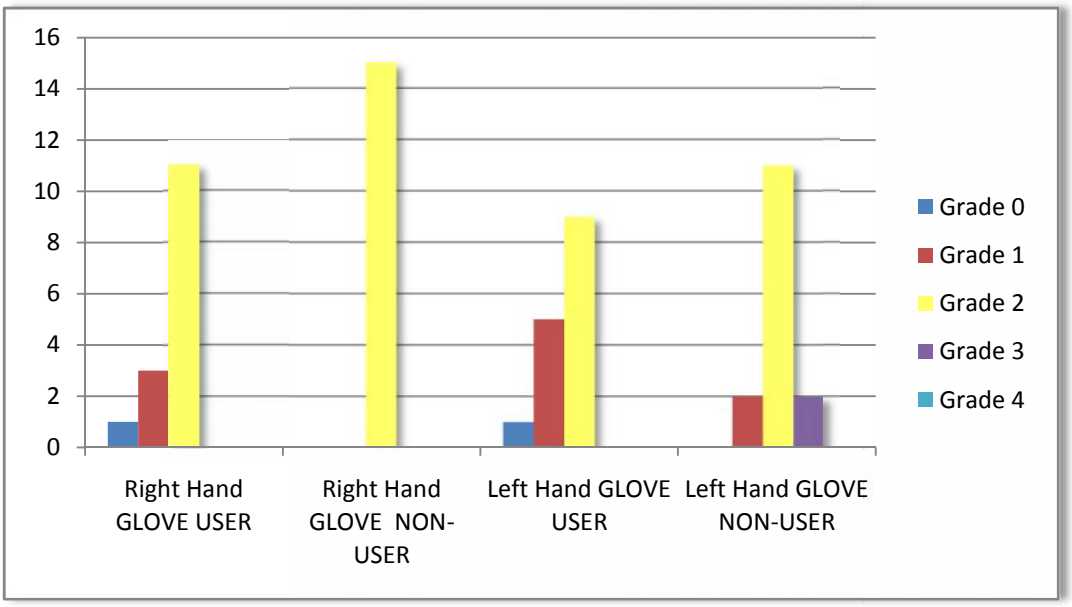
X	0	1	2	3	4
Y	1	3	11	0	0

X	0	1	2	3	4
y	0	0	15	0	0

X	0	1	2	3	4
y	1	5	9	0	0

x	0	1	2	3	4
Y	0	2	11	2	0

X: Grade
Y: No. of workers



Bar Chart showing the above mentioned values in index finger

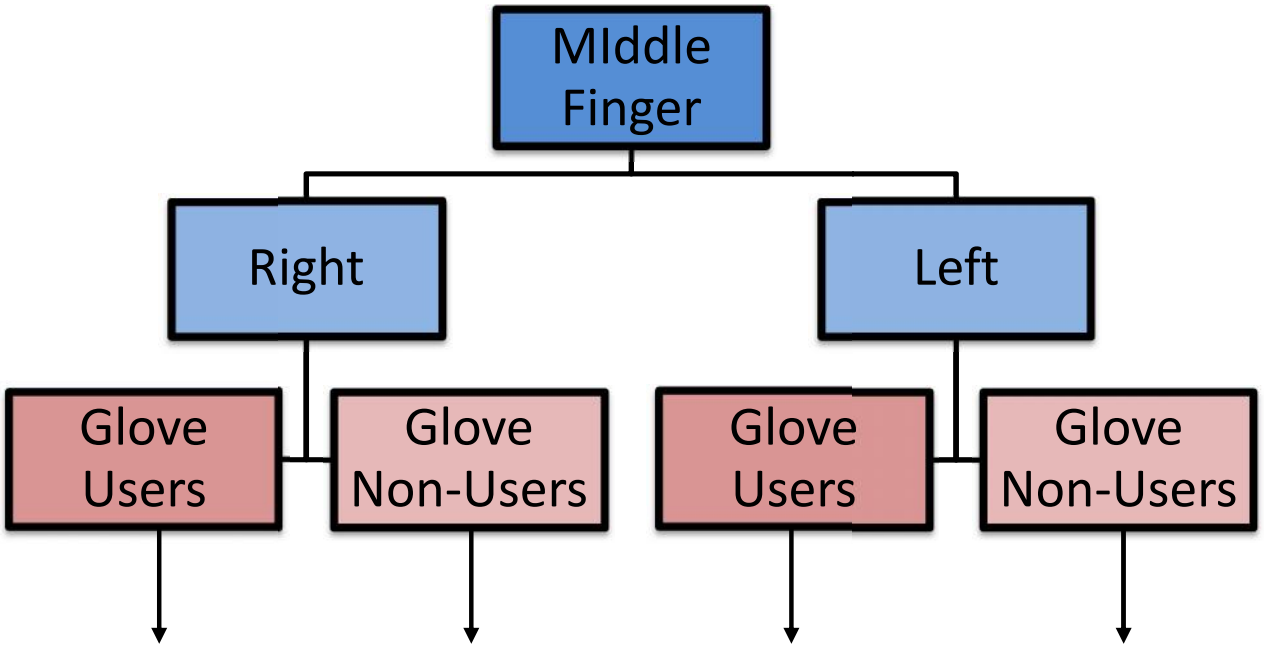
11 workers belonging to the user group had grade 2 dermatitis on the right and left index finger respectively whereas 15 & 11 workers had grade 2 dermatitis on right and left index fingers in the non user group.

Statistical analysis:

FINGERS	Test (T = 1) Users		Control (C=0) Non Users		t	p
	Mean	SD	Mean	SD		
Right Index	1.66	0.61	2.00	0.00	2.16	<0.05
Left Index	1.53	0.63	1.93	0.57	1.85	0.074

The “p” value obtained using the parameters observed in the pattern of dermatitis in the left index finger among the two groups did not show a statistically significant result. But in the right index finger, the p value was <0.05 which is suggestive of statistical significance.

Middle Finger:



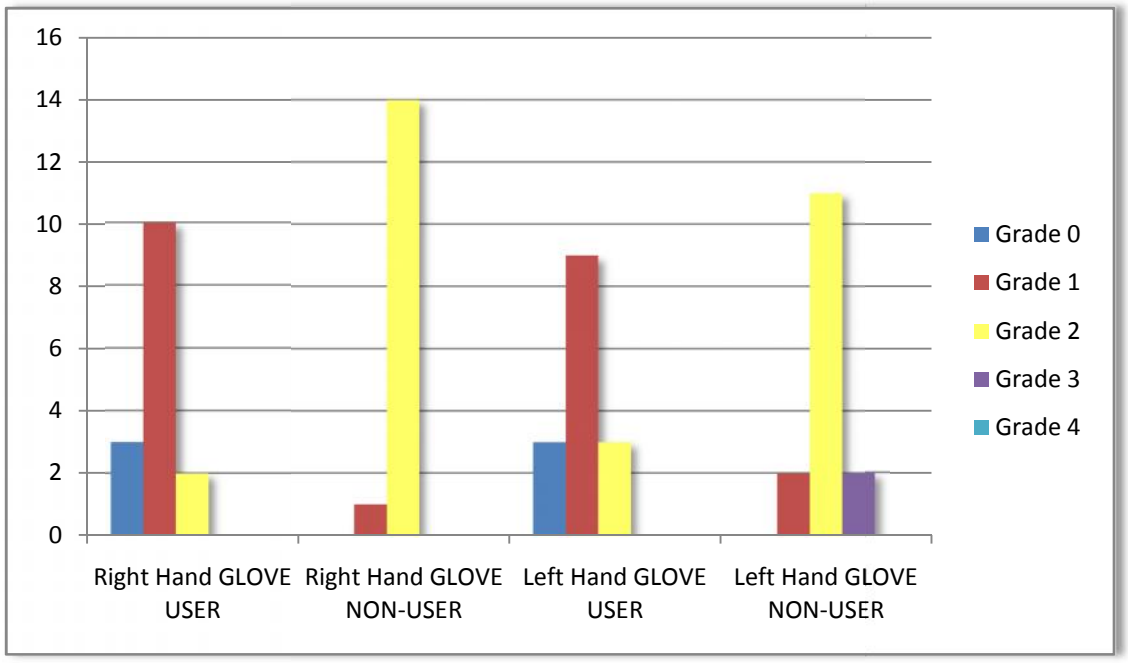
X	0	1	2	3	4
Y	**3**	**10**	**2**	**0**	**0**

X	0	1	2	3	4
y	**0**	**1**	**14**	**0**	**0**

X	0	1	2	3	4
y	**3**	**9**	**3**	**0**	**0**

x	0	1	2	3	4
Y	**0**	**2**	**11**	**2**	**0**

X: Grade
Y: No. of worker



Bar Chart showing the above mentioned values in Middle finger

In comparison, total of 2 workers out of 15 in the user group had grade 2 dermatitis, 10 had grade 1 severity and 3 had no dermatitis whereas 14 workers in the non user group had grade 2 severity on the right middle finger.

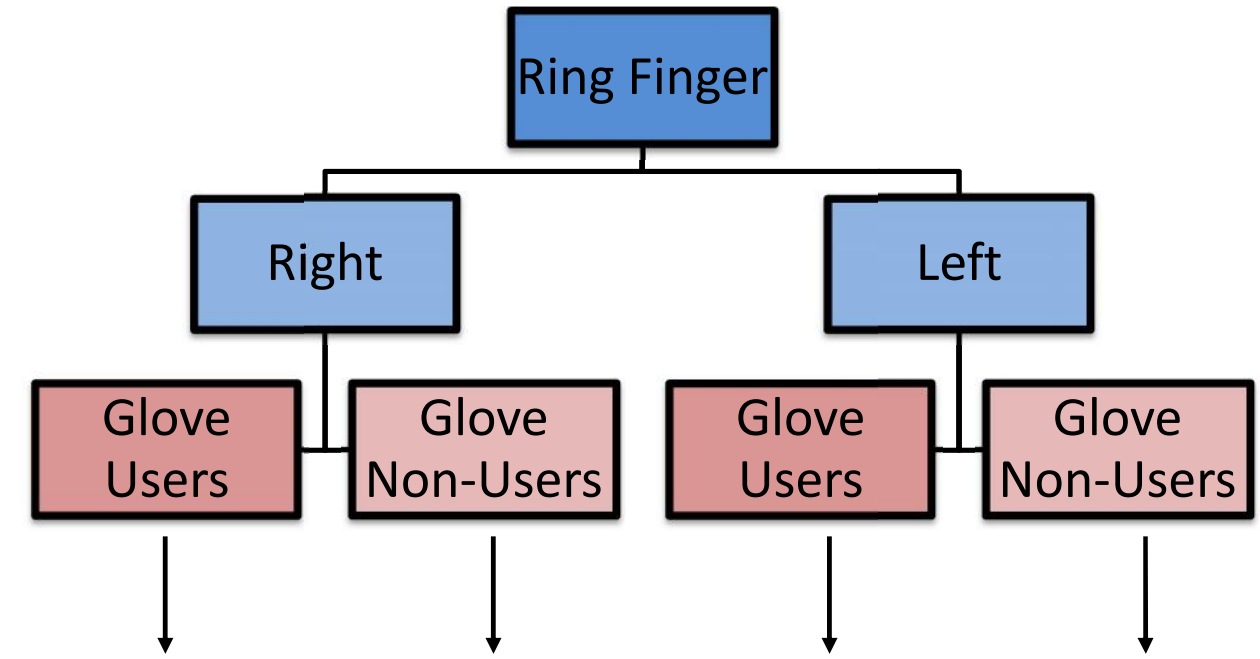
3 workers in the user group had 9 had grade 1 dermatitis grade 2 dermatitis whereas 2 workers had grade 1 dermatitis and 11 workers had grade 2 dermatitis on the left middle finger.

Statistical Analysis

FINGERS	Test (T = 1) Users		Control (C=0) Non Users		t	p
	Mean	SD	Mean	SD		
Right Middle	1.00	0.53	1.87	0.34	5.46	<0.05
Left Middle	1.00	0.65	1.93	0.7	4.24	<0.05

Statistically significant values were obtained on comparing the pattern of dermatitis in the right and left middle fingers.

Ring Finger:

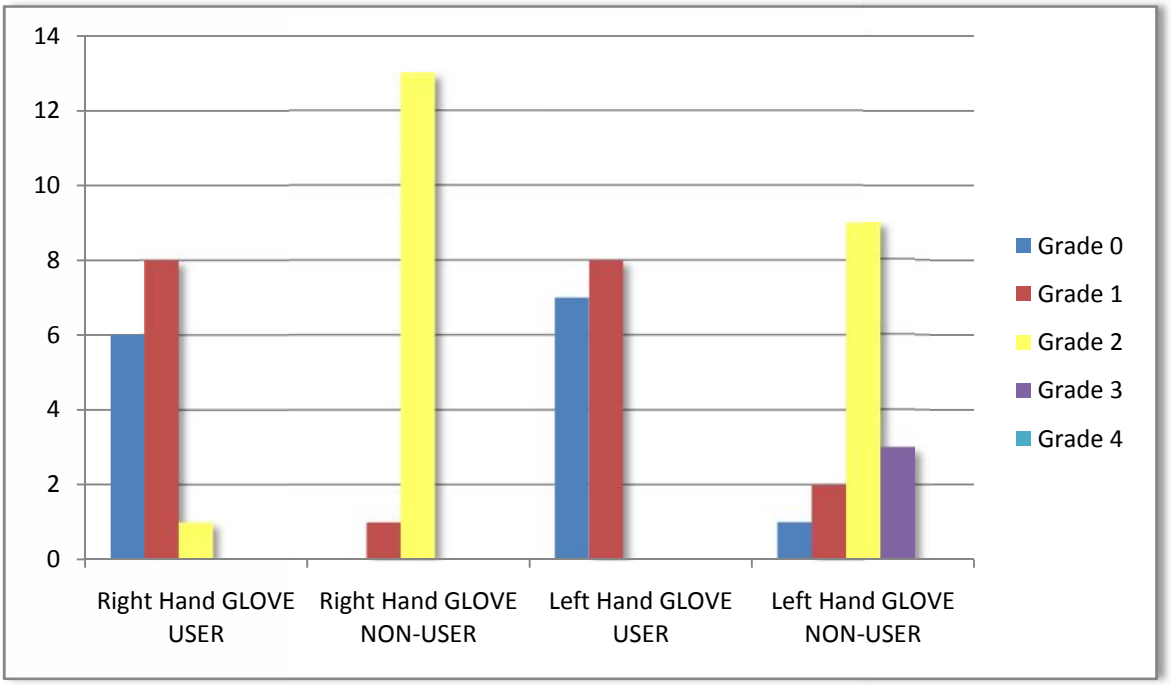


X	0	1	2	3	4
Y	**6**	**8**	**1**	**0**	**0**

X	0	1	2	3	4
Y	**0**	**1**	**13**	**1**	**0**

X	0	1	2	3	4
Y	**7**	**8**	**0**	**0**	**0**

X	0	1	2	3	4
Y	**1**	**2**	**9**	**3**	**0**



Bar Chart showing the above mentioned values in Ring Finger

On the right ring finger, majority in the user group had grade 1 dermatitis that is 8 workers had grade 1 dermatitis and 6 had no dermatitis. Severity of grade 2 was seen in 1 worker. In the glove non user group, majority (13 workers) had severity of grade 2. Severity of grade 3 was seen in 1 worker.

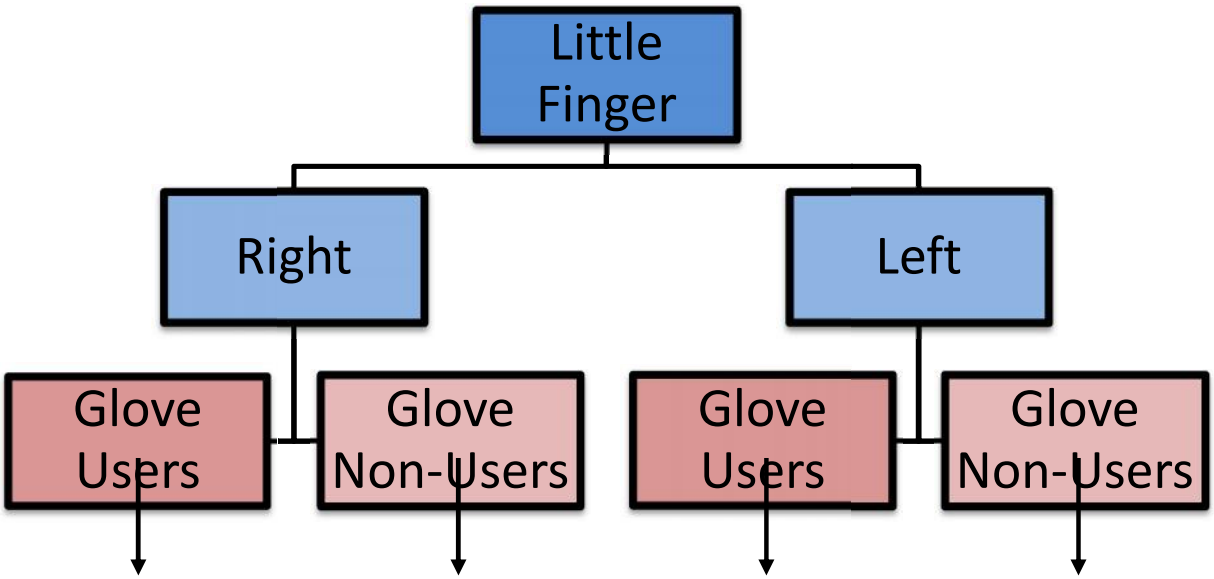
No worker had grade 2, 3, 4 dermatitis among the glove users on the left ring finger. But 12 workers presented with dermatitis of severity 2&3 in the glove non user group on the left side.

Statistical Analysis:

FINGERS	Test (T = 1) Users		Control (C=0) Non Users		t	p
	Mean	SD	Mean	SD		
Right Ring	0.60	0.63	1.93	0.44	6.85	<0.05
Left Ring	0.46	0.51	1.87	0.80	5.74	<0.05

A “p” value of 0.000 (<0.05) was obtained on comparing the dermatitis among the 2 groups. This value is of statistical significance.

Little Finger



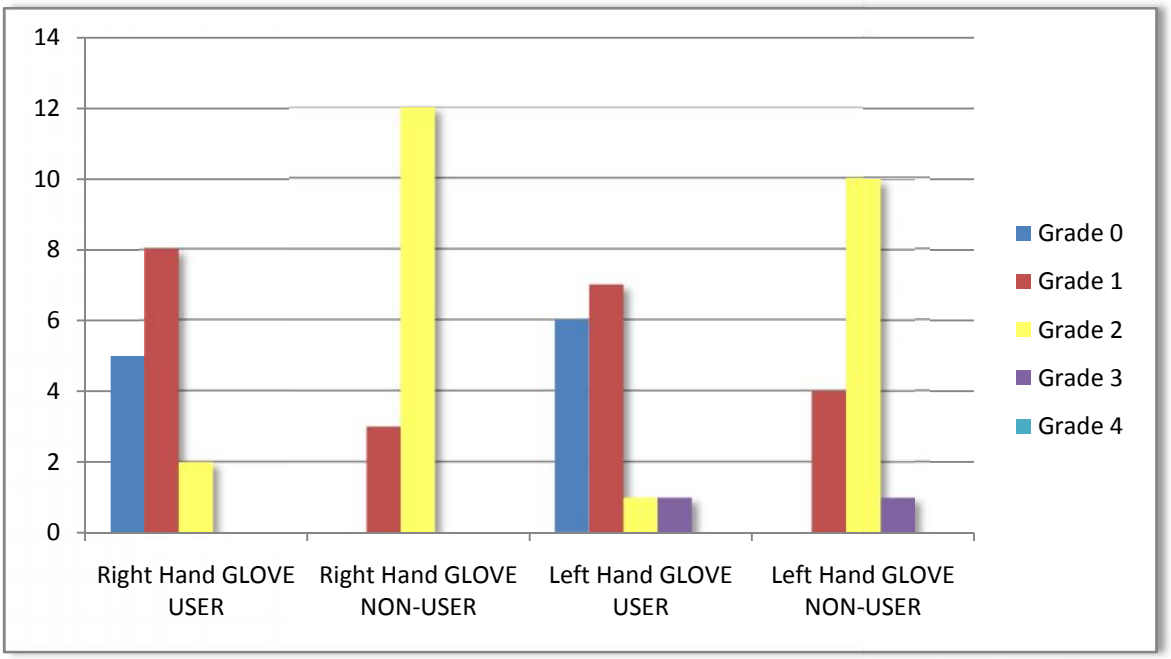
X	0	1	2	3	4
Y	**5**	**8**	**2**	**0**	**0**

X	0	1	2	3	4
Y	**0**	**3**	**12**	**0**	**0**

X	0	1	2	3	4
y	**6**	**7**	**1**	**1**	**0**

X	0	1	2	3	4
Y	**0**	**4**	**10**	**1**	**0**

X: Grade
Y: No. of workers



Bar Chart showing the above mentioned values in Little Finger

12 workers in the non user group had grade 2 dermatitis on the right little finger. 2 workers in the user group had grade 2 dermatitis in right side. On the left side, 10 workers presented with grade 2 dermatitis in the non user group. Among the 15 workers in the user group, 1 had grade 2 dermatitis.

Statistical analysis

FINGERS	Test (T = 1) Users		Control (C=0) Non Users		t	p
	Mean	SD	Mean	SD		
Right Little	0.86	0.74	1.75	0.44	4.04	<0.05
Left Little	0.88	0.86	1.75	0.57	3.62	<0.05

Statistically significant results were obtained in right and left little fingers on comparing the severity of dermatitis among the glove users and the glove non users.

OBSERVATIONS

OBSERVATIONS

Overall pattern of Dermatitis observed among the workers:

As workers in the shelling section were included in the study, the parameters used to determine the degree of dermatitis and the scoring system used. Overall severity of the various changes seen over face, chest, dermatoglyphics, forearm, feet, nails, both hands and fingers (palmar and dorsal aspect) were graded separately on severity grading scale as mentioned below. The grading system consists of affixed scores allotted to each of the parameters depending on clinical severity. (Table 4, 5, 6)

Most of the workers in this section were dressed in sarees and blouses. Some workers were seen wearing the traditional Kaili (loin cloth made of cotton) and blouses.

The skin changes noted were:

- Brownish, shiny, well demarcated and slightly elevated keratotic plaques with irregular margins over the palms and palmar aspects of digits, sparing the creases and involving the areas proximal to the first, second and third metacarpophalangeal joints prominently.(fig.10)

- These changes were relatively absent in the thenar and hypothenar eminences.

- Deep fissures were present along the finger tips but more prominently over the thumb, index and middle fingers.

- Numerous tiny, circular irregular pits were noted over the palms and palmar aspects of the digits.(fig.11)

- Greyish pink maceration was also noted over the digits on both the dorsal and palmar aspects.

- The finger tips showed loss of dermatoglyphics on close examination in a few workers.

- There was no evidence of paronychia. Web spaces were spared.

- The dorsa of the digits and hands showed brownish discoloration and uniform thickening of the skin.(fig.12)

- Nails showed fraying and nicking of the edges due to trauma from the cashew nut held firmly while shelling.(fig.13)

- The medial aspect of left thumb and dorsal aspect of left index finger were more damaged.

- Brownish staining from cashew shell oil, subungal hyperkeratosis and onycholysis were also noted.(fig.13)
- Tapering of fingers from proximal to distal end was noted.
- Tiny black scabs were also noted over the lower part of the face, neck, V area of the upper chest, flexor aspect of the lower arm, flexor aspect of forearm and anterior aspect of legs due to irritant reaction from cashew oil which is liberated during the shelling process.
- Similar changes were seen over the exposed part of the anterior and anterolateral aspect of abdominal wall, mainly on the left side.
- The dorsa of feet showed diffuse thickening of the skin along with blackish brown pigmentation.
- Instep of feet and plantar aspect of tip of toes showed fissuring.
- Toe nails showed brownish black staining.
- Fissures and cracks were noted on the heels.
- The weight bearing areas of heels and forefoot showed hyperkeratotic plaques.
- Some workers had pitted keratolysis like lesions over the soles.
- The other areas involved were the soles, nails, 'V' area of neck, forearms, lower part of arms, legs, and feet.

In short, all areas not covered by clothing were involved. Some changes were noted on the exposed midriff.

Overall severity of the various changes discussed was graded in a 5 point 0-4 scale.

SEVERITY GRADING SCALE:

0	NO DERMATITIS
1	MILD DERMATITIS WITH SCALING
2	BETWEEN 1 & 3; WITH PIGMENTATION
3	THICK BLACK PLAQUE
4	ULCERATION AND FISSURING

We examined 40 workers for the assessment of pattern of dermatitis in the cashew industry. All forty had clinical findings of varying severity as described above.

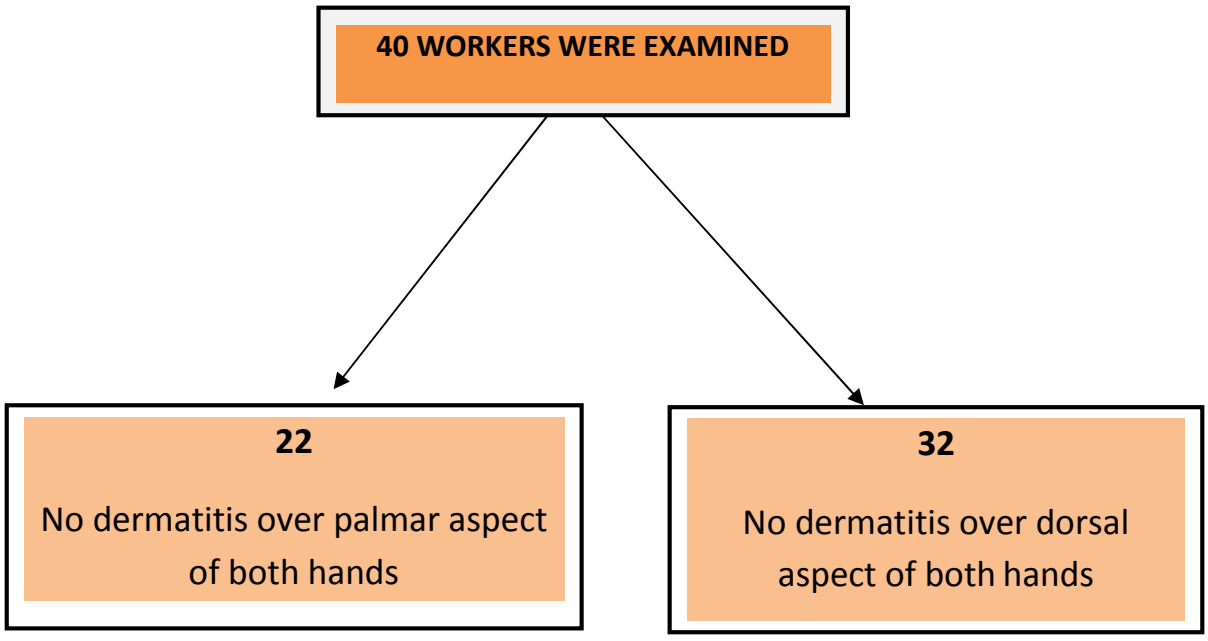
Since our aim was to compare the severity of dermatitis over the palmar aspect of fingers among those using the rubber finger glove and those who do not, only findings over the fingers were recorded for comparison.

During the shelling process it is evident that palmar aspect of fingers are mainly in contact with the irritant effect of cashew nut shell oil.

Out of the forty workers examined,

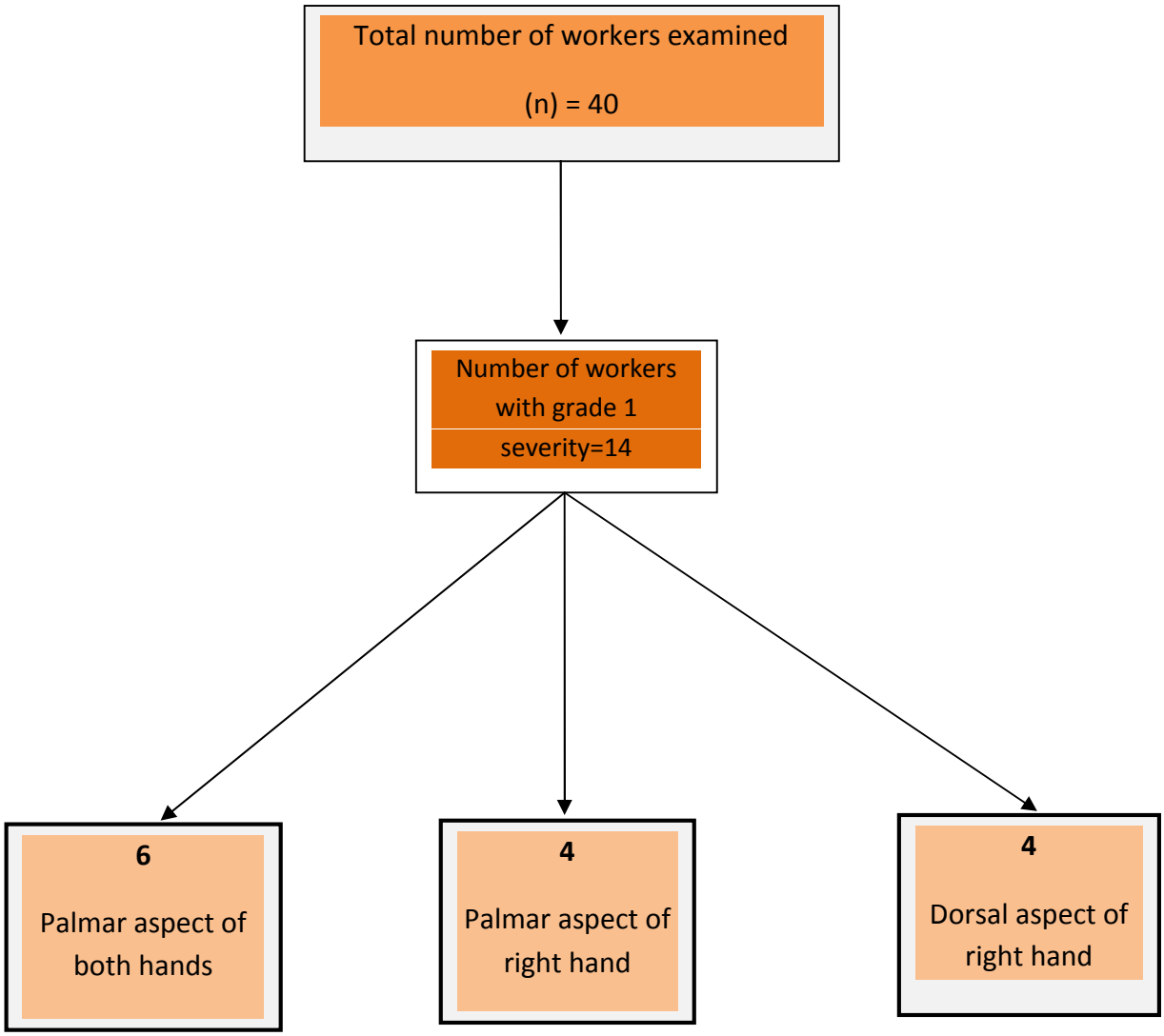
Twenty-two did not have dermatitis in the palmar aspect of both hands.

Thirty-two workers did not have dermatitis over dorsal aspect of both hands.(Table 6)



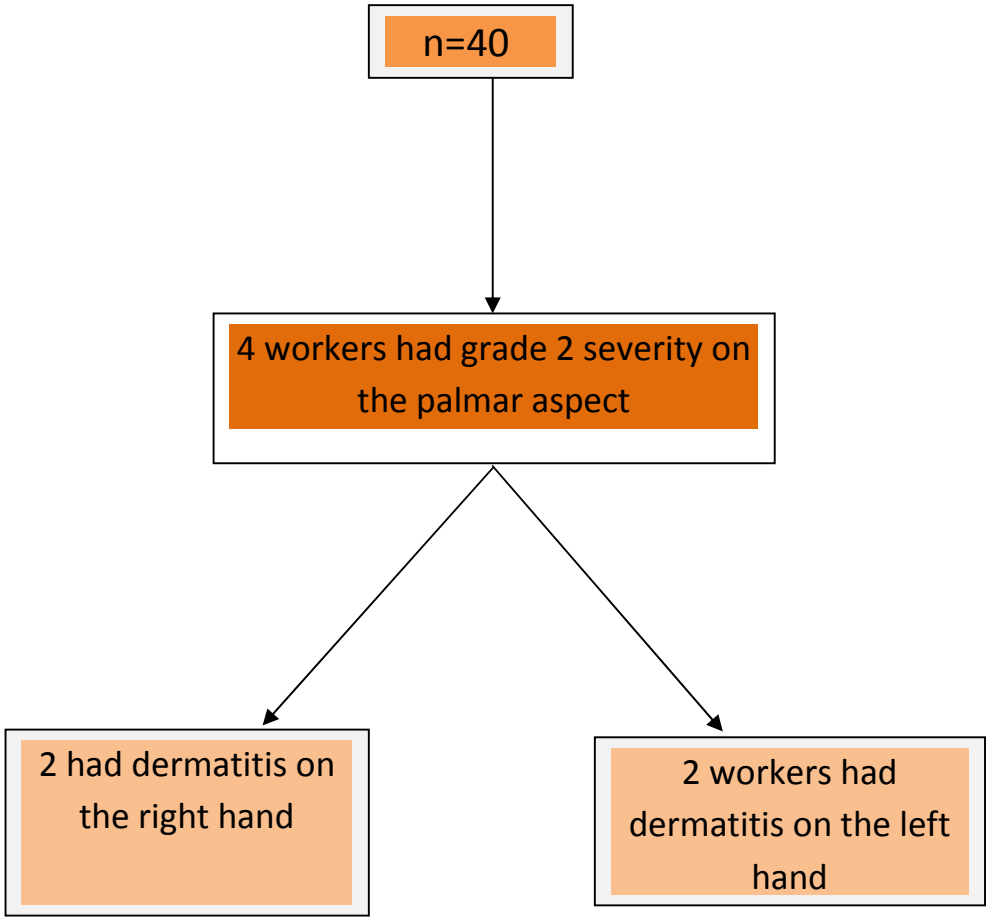
Grade 1 severity was noted in the following subset of workers:

Results are represented by the following flow chart.



Six workers had dermatitis of grade 1 severity over palmar aspect of both hands. Four workers had dermatitis of grade 1 severity over palmar aspect of right hand. Four workers had dermatitis of grade 1 severity over dorsal aspect of right hand.(Table 6)

Grade 2:



Dermatitis of grade 2 severity was seen in four workers among whom two presented with dermatitis over the palmar side of right hand and the other two had the same on the left palmar aspect. (Table 6)

Grade 3: (Table 6)

- Out of the 40 workers examined, only 2 workers had dermatitis of grade 3 severity.
- Grade 3 severity was noted only on the palmar side of left hand.
- On the dorsal aspect of hands, this feature was not observed.

Grade 4:(Table 6)

- Palmar aspect of the right hand in 1 worker showed dermatitis of grade 4.
- None of the workers had grade 4 dermatitis on the dorsa of hands.

Grading section:

- Most of those engaged in grading work also performed the peeling work.
- Fissuring of fingers was noted in those workers in the peeling section. Fissuring was more seen in the thumb and index finger on both hands due to the specific rolling movements performed by the workers to aid in the detachment of the skin from the nut.

Shell oil section:

- Four men were examined from this section.
- The men working in this section were aged between 45-60 years.

- Soles showed uniform irritant reaction with blackening of the skin. These changes are more prominent over the weight bearing areas that is the heel and heads of metatarsals.
- Arches of feet were spared.
- Both palms show numerous pitted lesions resembling those seen in shelling section workers. These pits were seen in greater number along the periphery of the palms and on the thenar eminences with relative sparing of the centre of the palm.
- The dermatoglyphic lines appear smoothed out over the finger tips of both hands.
- The skin of the palm and palmar aspect of digits appeared smooth, shiny, greasy and thickened.
- The toe nails were brownish, thick and frayed at the digital edges.
- Features of systemic contact dermatitis were not observed.
- Only areas where the irritant oil came into contact showed features of dermatitis.

DISCUSSION

DISCUSSION

Industrial dermatology is interesting because, it is often possible to see a large number of individuals manifesting a particular set of signs and symptoms which one hardly come across in the routine hospital practice. One of the commonly encountered problems in dermatological practice is dermatitis to plants belonging to numerous families. It may be irritant, allergic, photoallergic, or phototoxic.

Contact dermatitis to members of the family Anacardiaceae is common in India and abroad. They have the special feature of having more numerous potentially allergenic plants, than in any other family.[2] Cashew industry is a labour intensive industry requiring skill at almost every stage. India produces about 2 lakh tons of cashew per year, employing about 150,000 labourers in cashew factories. Kollam, situated in the southern parts of Kerala, alone exports 70% of processed kernels from the total quantity exported.

Kerala employs more than 20,000 labourers in the cashew industry. About 13575 metric tons which is worth 60 Crores INR of cashew shell oil are exported every year.[3] The women of the locality perform all the manual work. That is the reason why all the subjects included in this study are women.

The cashew industry is thus a major source of sustenance among the rural population in these areas. The major reason for this is the fact that the cashew industry is highly labour intensive at different stages of processing and grading.

During the shelling process these women come into contact with the noxious cashew nut shell oil liquid. This is implicated as the cause of dermatitis in this particular population. This study demonstrates the efficacy of protective rubber gloves in preventing dermatitis in a cashew factory in Kollam, Kerala.

Allergic contact dermatitis to members of the family Anacardiaceae is well known. It is reported that cross sensitivity in a sensitized individual who is exposed to one member of the family can experience a flare of dermatitis on contact with another member of the family.[2]

There appears to be a lack of literature on the irritant action of the Anacardiaceae plant or its specific parts, though references to Semecarpus Anacardium, Anacardium Occidentale and Holigarna Arnottiana have been made.[2]

Currently there are no reports available for studies like ours. Only limited literature is available with regard to irritant reactions among cashew factory workers. This is probably due to the fact that the shelling operations which are the cause of dermatitis are fully mechanised in other countries[2] and the human hands seldom come in contact the cashew shell liquid directly as in our labour intensive factories.

We examined most of the workers from all the sections but recorded the findings with regard to the pattern of dermatitis in 40 workers from the shelling section. The workers in the shelling section and from the shell oil section developed irritant reactions clinically as they showed dermatitis only in areas that came in direct contact with the shell oil that is over the hands , feet, small areas of acute irritant reactions over the forearm, 'V' of the neck, face and midriff where the oil had splashed. The dermatitis in all these individuals subsides once they discontinue work and the skin reverts to its original appearance a month following discontinuation, except for gross changes such as tapering and nail changes.

The dermatitis begins shortly after they start working and is absent among workers who failed to come in contact with cashew nut shell liquid but work in the same factory. The irritant nature of cashew nut

shell oil liquid is because of its high anacardic acid content of 70 per cent in unprocessed cashew nut shell oil liquid.

The dermatoses found in the peeling section, grading section and cashew nut shell oil extraction section were related to mode of work. The workers in these sections showed no allergic contact dermatitis or systemic type reactions clinically.

After assessing the overall pattern of dermatitis, we randomly chose 30 workers from the shelling section amongst which 15 used rubber finger gloves and the remaining 15 were non glove users to take part in this study. After obtaining informed consent, the severity of dermatitis was graded on the palmar side of the fingers separately in individual fingers. Photographs were taken by the same photographer using the same camera, same lighting and maintaining the same distance. A blinded observer scored the severity of dermatitis using the severity grading scale based on the photographs.

Data obtained were subjected to statistical analysis using SPSS 19. Mean SD were calculated and “t” test was used to compare the mean values. p value <0.05 was considered to be statistically significant.

Statistically significant values were obtained on the right index finger, right and left middle finger, right and left ring finger and right and left little finger.(Table 7)

Various modalities have been tried in preventing contact dermatitis. Topical applications and barrier creams being some among them. Barrier creams have been used as prophylaxis against irritant as well as allergic contact dermatitis.[21] Repeated applications and high cost being the disadvantages.

In our study which was undertaken to assess the efficacy of rubber finger gloves as described in materials and methods it was observed that the severity of dermatitis was less among the workers who regularly used the rubber finger gloves when compared to workers who do not use the gloves.(fig 14,15)

In conclusion, as in India, where labour is economical, it is unlikely that mechanization of the cutting process is likely to come in the near future. The only solution for the severe irritant dermatitis observed in cashew factory workers is by finding the most economic, easily available, acceptable and effective protective device.

We intend to conduct further studies by assessing the composition of gloves, increasing the duration of study and finding alternate rubber finger gloves to offer further protection.

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

Workers in the cashew factory develop severe dermatitis over the hands following contact with cashew nut shell oil liquid. Less severe irritant dermatitis occurs over other areas such as forearm, V area of neck, face, chest, exposed midriff and feet.

We examined 40 workers, all of whom showed the dermatitis in various severities involving mostly the hands. Since some workers used finger gloves while working and the others didn't use the gloves, we examined 15 workers who use the gloves and 15 workers who did not use the gloves and compared the severity between both the groups.

Since the gloves protected only the fingers, we compared the severity over each finger of worker who use rubber finger gloves and who did not use the gloves. The right index finger, right middle finger, left middle finger, right ring finger, left ring finger, right little finger and left little finger showed significantly less severe dermatitis among the rubber finger glove users when compared to those who did not use the finger gloves.(Table 7)

The right thumb, left thumb and the left index finger showed relatively less severe dermatitis among those who used the rubber finger gloves. But the difference was not statistically significant.(Table 7)

This could be because these fingers exert more pressure and may subject to more friction resulting in relatively frequent damage of the protective finger gloves which may permit the contact of the finger with the cashew nut shell oil liquid. In these fingers we intend to conduct a study using double layered gloves for better protection.

We conclude that, use of finger glove offers significant protection for glove users when compared to those who do not use the gloves. We plan to undertake in vitro and vivo studies to find more suitable and acceptable gloves for all the workers.

Figure1: Cashew apple with the nut

Figure 2: The cashews are sundried before sending to the factory and are encased in their shells

Figure 3: Drum Heating

Figure 4: Shelling

Figure 5: Roasting

Figure 6 : Hand peeling

Figure 7

Figure 8: Gloves used in this study

Figure 9: Colour change (fading) of the glove noted.

Figure :10 Elevated keratotic plaques with irregular margins over the palms and palmar aspects of digits.

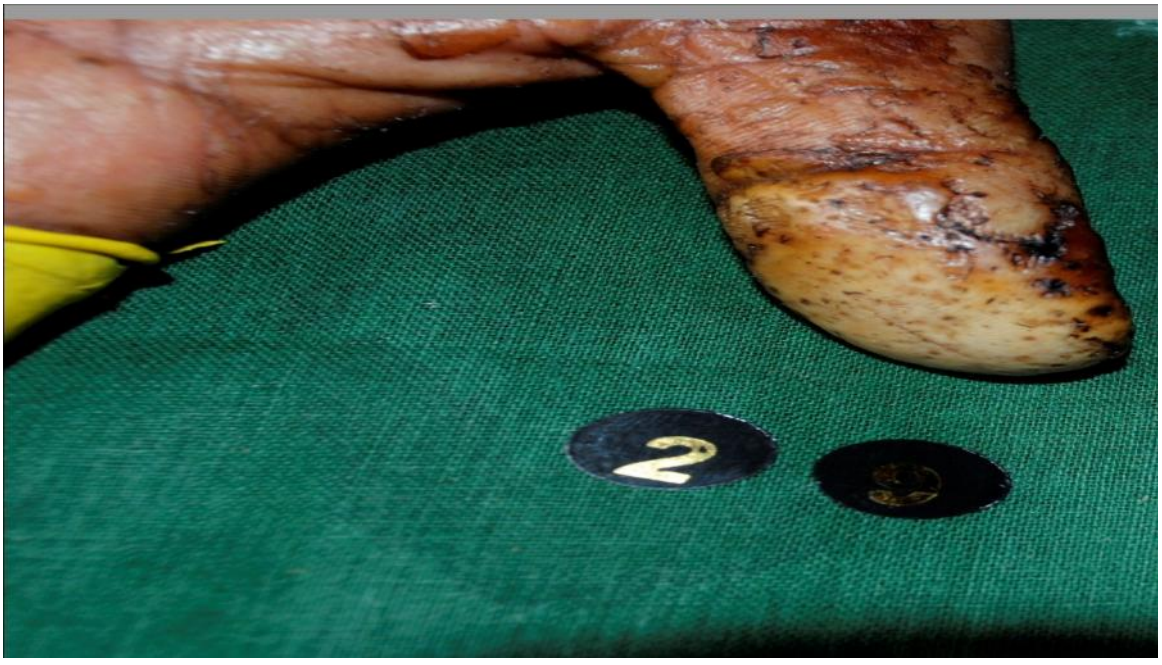


Figure 11 : Numerous tiny, circular irregular pits

Figure 12: Nails showed fraying and nicking of the edges and Brownish staining from cashew shell oil

Figure 13: Dorsa of the digits showing brownish discoloration and thick plaques.

Figure 14 : Worker with finger glove; dermatitis seen over palm thumb and little finger.

Figure 15 : Same workers without gloves

Institutional Human Ethics Committee

POST BOX NO. 1674, PEELAMEDU, COIMBATORE 641 004, TAMIL NADU, INDIA
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Proposal Number	:	**12/126**
Project Title	:	**Study the pattern of dermatoses among workers in Cashew nut industry and to assess the protective efficacy of rubber finger glove as a barrier in patients with dermatoses**
Investigator(s)	:	**Dr Anjana Mohan**
Institution	:	**PSGIMS & R**
Name of the Guide(s)	:	**Dr C R Srinivas**
Institution	:	**PSGIMS & R**
Waiver of Consent	:	**Yes**
Review Type	:	**Exempt**
Date of the Meeting	:	**N/A**
Decision	:	**Approved**
Approval Date	:	**11.07.2012**
Validity of the Approval	:	**One year**

Approval for this study is given under the following terms and conditions:

1. Non-adherence to the Standard Operating Procedures (SOP) of the Institutional Human Ethics Committee (IHEC) and national and international ethical guidelines shall result in withdrawal of approval (suspension or termination of the study). SOP will be revised from time to time and revisions are applicable prospectively to ongoing studies approved prior to such revisions.

2. PIs are required to send progress reports (in the form of an extended abstract with publications if any) to the IHEC every six months (and a month before expiry of approval date, if renewal of approval is being sought).

3. Request for renewal must be made at least a month ahead of the expiry of validity along with a copy of the progress report.

11/07/2012

Dr Y S Sivan
Member - Secretary

SECRETARY
PSGIMS & R
COIMBATORE 641 004
INSTITUTIONAL HUMAN ETHICS COMMITTEE

ഇടം:

തീയതി:

പേര്:

സത്യവാങ്മൂലം

ഞാൻ വിലാസം: ..... തീയതി: ..... ന് ഇതിനാൽ സത്യപ്രസ്താവന ചെയ്യുന്നത് എന്തെന്നാൽ

ഈ പഠനത്തിന് നിന്നും ലഭിക്കുന്ന വൈദ്യുതോപാധനം ഭാവിയിൽ എനിക്ക് ഉപകാരപ്രദമായിരിക്കുന്നതിനാൽ.

ഈ പഠനത്തിന് വിഭാവനചെയ്തിരിക്കുന്ന എൻ പഠനത്തിൽ നിന്നും പിന്മാറാൻ എനിക്ക് സ്വതന്ത്രമായ അവകാശമുണ്ട് എന്നും എനിക്ക് അറിയാവുന്നതാണ്.

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(ഒപ്പ്) പൂർണ്ണമായും വായിച്ചുമനസ്സിലാക്കിയശേഷം ഒപ്പിട്ടുള്ളതാകുന്നു.

.....

ക്കുറിച്ചും ഉദ്ദേശങ്ങളെക്കുറിച്ചും ഞാൻ എന്റെ പൂർണ്ണ സംതൃപ്തിയോടെ മനസ്സിലാക്കിയതിന്റെ അടിസ്ഥാനത്തിൽ ഈ പഠനത്തിൽ പങ്കെടുക്കുന്നതിന് സമ്മതിക്കുന്നു. ഈ പഠനത്തിന്റെ ലക്ഷ്യങ്ങളും അതിന്റെ പ്രവർത്തനരീതിയെ

ഇടം:

തീയതി:

പേര്:

സത്യവാങ്മൂലം

ഞാൻ വിലാസം: ..... തീയതി: ..... ന് ഇതിനാൽ സത്യപ്രസ്താവന ചെയ്യുന്നത് എന്തെന്നാൽ

ഈ പഠനത്തിന് നിന്നും ലഭിക്കുന്ന വൈദ്യുതോപാധനം ഭാവിയിൽ എനിക്ക് ഉപകാരപ്രദമായിരിക്കുന്നതിനാൽ.

ഈ പഠനത്തിന് വിഭാവനചെയ്തിരിക്കുന്ന എൻ പഠനത്തിൽ നിന്നും പിന്മാറാൻ എനിക്ക് സ്വതന്ത്രമായ അവകാശമുണ്ട് എന്നും എനിക്ക് അറിയാവുന്നതാണ്.

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WORKER Code.	*THUMB*		*INDEX*		*MIDDLE*		*RING*		*LITTLE*	
1z	**2**	**2**	**2**	**2**	**0**	**0**	**0**	**0**	**1**	**0**
2z	**2**	**2**	**2**	**2**	**1**	**1**	**0**	**1**	**1**	**1**
3z	**0**	**4**	**0**	**2**	**0**	**2**	**0**	**1**	**0**	**3**
4z	2	2	2	2	2	2	2	2	2	2
A	2	2	2	1	2	2	2	2	2	2
B	2	2	2	2	2	2	3	3	2	2
C	**2**	**2**	**1**	**0**	**2**	**1**	**1**	**0**	**0**	**1**
D	2	2	2	2	2	2	2	2	2	2
E	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**0**	**1**	**1**
F	**3**	**3**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**
G	2	3	2	3	2	3	2	3	2	2
H	3	2	2	2	2	1	2	0	1	1
I	2	3	2	2	2	2	2	2	1	1
J	2	2	2	2	1	1	1	1	1	1
K	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**
L	2	3	2	3	2	3	2	3	2	3
M	**2**	**2**	**2**	**2**	**1**	**2**	**0**	**1**	**0**	**1**
N	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**0**	**2**	**1**
O	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**0**
P	2	3	2	2	2	2	2	2	2	2
Q	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**2**
R	2	2	2	2	2	2	2	2	2	2
S	**2**	**1**	**2**	**2**	**1**	**1**	**1**	**0**	**1**	**0**
T	2	2	2	2	2	2	2	2	2	2
U	2	2	2	2	2	2	2	2	2	2
V	**2**	**2**	**2**	**2**	**1**	**1**	**0**	**1**	**0**	**0**
W	2	2	2	2	2	2	2	2	2	2
X	**2**	**2**	**2**	**1**	**1**	**0**	**0**	**0**	**1**	**0**
Y	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Z	2	2	2	1	2	2	2	1	2	1
USERS	**29**	**32**	**25**	**23**	**14**	**14**	**10**	**8**	**12**	**12**
MEAN	**1.93**	**2.13**	**1.66**	**1.53**	**1.00**	**1.00**	**0.60**	**0.46**	**0.86**	**0.88**
NON USERS	31	34	30	30	29	30	30	29	27	27
MEAN	2.06	2.25	2.00	1.93	1.87	1.93	1.93	1.87	1.75	1.75

Table.1 Letters and Numbers (based on the severity grading scale) graded by a blinded observer, highlighted in Bold are indicative of the Glove user group (on the Palmar aspect of fingers).

	Workers	Right Fingers- Users					
		Thumb	Index	Middle	Ring	Little	
1	INDIRA	2	2	0	0	1	1
2	VIMALA	2	2	1	0	1	2
3	PANKAJAM	0	0	0	0	0	3
4	RAJAMMA	2	1	2	1	0	4
5	REMANI	2	1	1	1	1	5
6	VASANTHI	3	1	0	0	0	6
7	YAMUNA	2	2	2	2	1	7
8	RADHAMANI	2	2	1	1	0	8
9	GIRIJA	2	2	1	1	2	9
10	REMANI	2	2	1	1	2	10
11	SUMATHI	2	2	1	1	1	11
12	SANTHA	2	2	1	1	1	12
13	LALITHA	2	2	1	0	0	13
14	SARASAMMA	2	2	1	0	1	14
15	JAYA	2	2	1	1	1	15
Mean Value		1.93	1.66	1	0.6	0.86	Mean Value

Workers	Right Fingers - non users				
	Thumb	Index	Middle	Ring	Little
SUMA	2	2	2	2	2
SANTHI	2	2	2	2	2
THANKAMANI	2	2	2	3	2
RATHNAMMA	2	2	2	2	2
SANTHAMMA	2	2	2	2	2
RADHA	3	2	2	2	1
LAKSHMI	2	2	2	2	1
NAGAMMA	2	2	1	1	1
ANANDHAM	2	2	2	2	2
SARASAMMA	2	2	2	2	2
AMBIKA	2	2	2	2	2
VILASINI	2	2	2	2	2
RETHNAMMA	2	2	2	2	2
ANANDHAVALLI	2	2	2	2	2
SUDHA	2	2	2	2	2
	2.06	2	1.87	1.93	1.75

	Workers	Left Fingers- Users					
		Thumb	Index	Middle	Ring	Little	
1	INDIRA	2	2	0	0	0	1
2	VIMALA	2	2	1	1	1	2
3	PANKAJAM	4	2	2	1	3	3
4	RAJAMMA	2	0	1	0	1	4
5	REMANI	2	1	1	0	1	5
6	VASANTHI	3	1	0	0	0	6
7	YAMUNA	2	2	1	1	1	7
8	RADHAMANI	2	2	2	1	1	8
9	GIRIJA	2	1	1	0	1	9
10	REMANI	2	2	1	1	0	10
11	SUMATHI	2	2	2	1	2	11
12	SANTHA	1	2	1	0	0	12
13	LALITHA	2	2	1	1	0	13
14	SARASAMMA	2	1	0	0	0	14
15	JAYA	2	1	1	1	1	15
Mean Value		2.13	1.53	1	0.46	0.88	Mean Value

Workers	Left Fingers- Non users				
	Thumb	Index	Middle	Ring	Little
SUMA	2	2	2	2	2
SANTHI	2	1	2	2	2
THANKAMANI	2	2	2	3	2
RATHNAMMA	2	2	2	2	2
SANTHAMMA	3	3	5	3	2
RADHA	3	2	1	0	1
LAKSHMI	2	2	2	2	1
NAGAMMA	3	2	1	1	1
ANANDHAM	3	3	3	3	3
SARASAMMA	2	2	2	2	2
AMBIKA	2	2	2	2	2
VILASINI	2	2	2	2	2
RETHNAMMA	2	2	2	2	2
ANANDHAVALLI	2	2	2	2	2
SUDHA	2	1	2	1	1
	2.25	1.93	1.93	1.87	1.75

	Workers	Chest	Face	Dermatoglyphics		Forearm	
				Right	Left	Right	Left
1	SANTHA		0	0	0	0	0	0
2	THANKAMANI		0	0	0	0	0	0
3	AMBUJAKSHI		0	0	0	0	0	0
4	RAJAMMA		0	0	0	0	0	0
5	RETHNAMMA		0	0	0	0	SCABS	0
6	REMANI		0	0	LOST	0	0	0
7	PADMAVATHI		0	0	0	0	0	0
8	VASANTHI	SCAB		0	0	0	0	0
9	MAHILAMANI		0	0	0	0	0	0
10	KOMALAVALLI		0	0	0	0	0	0
11	YAMUNA		0	0	0	LOST	0	0
12	SRIDEVI		0	SCABS		0	0	0	0
13	REMANI		0	0	0	0	0	SCAB
14	PONNAMMA		0	0	LOST	LOST	0	0
15	SANTHAMMA		0	0	0	0	0	0
16	RADHA		0	0	0	0	0	0
17	GIRIJA		0	0	0	LOST	0	0
18	VAVACHI		0	0	0	LOST	0	0
19	RAJAMANI		0	0	0	0	SCABS	0
20	LAKSHMI		0	0	0	0	0	0
21	NAGAMMA		0	0	0	0	0	0
22	SUMATHY		0	SCABS		0	0	0	0
23	LATHA		0	0	0	0	0	0
24	SINDHU		0	0	0	0	0	0
25	SAVITHRI		0	0	0	0	0	0
26	REMA		0	0	0	0	SCABS	0
27	SARASAMMA	SCAB		0	0	0	0	0
28	ANANDHAM		0	0	LOST	LOST	0	0
29	BINDHU		0	0	0	0	0	0
30	AMBIKA		0	0	LOST	LOST	0	0
31	SUMATHY		0	0	0	0	0	0
32	VILASINI		0	0	0	0	0	0
33	SANTHA		0	0	LOST	LOST	0	0
34	RETHNAMMA		0	0	0	0	0	0
35	LALITHA		0	0	0	0	0	0
36	SARASAMMA		0	0	0	0	0	0
37	SUDHA		0	0	0	0	0	0
38	ANANDHAVALLI		0	0	0	0	0	0
39	JAYA		0	0	0	0	0	0
40	JAGADAMMA		0	0	0	0	0	0

Feet	
Right	Left
2	0
1	1
2	2
1	1
1	1
0	0
0	0
1	1
1	1
0	0
1	2
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	1
1	0
1	1
2	2
0	0
0	0
1	1
1	1
0	0
1	1
1	1
1	1
1	1
1	1
1	1
0	0
1	1
0	0
0	0
1	1
0	0
0	0

Table 5

Workers		Right hand															Left hand												
		thumb			index			middle			ring			little			thumb			index			middle			ring			little	
		P	D	N	P	D	N	P	D	N	P	D	N	P	D	N	P	D	N	P	D	N	P	D	N	P	D	N	P	D
1	santha	3	1	0	2	2	0	2	2	0	2	2	0	2	2	0	2	1	0	2	1	0	1	1	0	1	2	0	1	3
2	thankamani	3	0	0	3	0	0	3	0	0	3	2	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	1	3	3
3	ambujakshi	2	1	0	3	0	0	3	0	0	3	0	0	3	1	0	2	0	0	1	0	0	1	1	0	2	0	0	1	1
4	rajamma	2	0	0	0	0	0	1	0	1	0	0	1	0	0	0	2	0	1	0	0	0	1	0	0	1	0	0	0	0
5	rethnamma	3	1	0	3	1	0	3	2	0	3	2	0	2	2	0	2	1	0	1	1	0	1	2	0	2	1	0	1	1
6	remani	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0
7	padmavathi	2	0	0	2	0	1	1	0	0	1	0	0	0	0	0	2	0	0	1	0	0	1	1	0	1	0	0	1	0
8	vasanthi	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0
9	mahilamani	2	2	1	1	0	1	1	1	1	1	1	1	1	1	1	2	3	0	2	1	0	1	0	0	1	0	0	1	0
10	komalavalli	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	1	0	1	1	0	1	1	0	0	1	0	0	0
11	yamuna	1	0	0	2	1	0	3	0	0	3	0	0	1	0	0	2	1	0	2	0	0	2	0	0	1	0	0	1	2
12	sridevi	1	1	0	1	2	0	1	3	0	1	2	0	2	1	0	2	1	0	1	3	0	1	3	0	1	3	0	1	0
13	remani	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	2	0	1	0	0	1	0	0	1	0
14	ponnamma	2	2	0	2	2	0	1	0	0	1	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0
15	santhamma	2	1	0	2	1	0	2	2	0	3	1	0	2	1	0	2	2	0	2	2	0	3	3	0	3	3	0	2	2
16	radha	2	2	0	1	1	0	1	1	0	1	1	0	0	1	0	2	3	0	1	2	0	1	1	0	0	0	1	0	1
17	girija	1	2	0	2	1	0	0	0	0	0	0	0	1	0	0	1	1	1	2	1	0	0	0	0	0	0	0	1	0
18	vavachi	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2	2	1	2	2	0	1	0	0	0	0	0	1	0
19	rajamani	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	2	0	1	2	0	0	1	0	1	0	0
20	lakshmi	1	1	0	2	1	0	2	3	0	2	1	0	1	1	0	1	3	0	2	3	0	2	3	0	3	3	0	2	3
21	nagamma	2	2	0	2	2	0	1	1	0	0	0	0	1	0	0	1	2	0	1	1	0	1	1	0	1	0	0	1	0
22	sumathi	2	2	0	2	0	0	2	0	0	2	1	0	2	1	0	2	2	0	2	1	0	2	2	2	2	2	2	2	2
23	latha	2	1	0	2	1	0	2	0	0	2	0	0	1	0	0	2	1	0	1	1	0	1	1	0	0	1	1	0	1
24	sindhu	2	2	0	2	1	1	1	0	0	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
25	savithri	2	1	0	3	2	0	3	2	0	2	2	0	2	1	0	1	2	0	2	1	0	1	1	1	1	1	1	1	1
26	rema	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
27	sarasamma	2	1	0	2	0	0	2	0	0	2	0	0	1	1	0	3	1	0	3	2	0	3	3	0	2	2	0	2	3

Shows the severity of dermatitis (based on severity grading scale) in the right hand and left hand over individual fingers

Abreviations: P - Palmar, D - Dorsal, N - Nail

Table 5

28	anandham	1	0	0	2	0	0	2	2	0	3	2	0	3	2	0	2	2	0	3	2	0	3	3	0	3	3	0	3	3
29	bindu	1	1	0	1	1	0	1	1	0	1	1	0	1	0	0	1	1	0	1	1	0	1	1	0	0	0	0	0	0
30	ambika	2	0	0	2	0	0	2	1	0	2	1	0	1	0	0	2	0	0	2	3	0	3	3	0	2	3	0	2	3
31	sumathi	2	2	0	2	2	0	1	0	0	0	0	0	1	0	0	2	3	0	2	2	0	1	1	0	1	0	0	1	0
32	vilasini	2	2	0	2	2	0	2	2	0	2	3	0	2	1	0	2	1	0	2	2	0	3	3	0	3	3	0	2	3
33	santha	2	2	0	2	2	0	1	0	0	1	0	0	1	0	0	2	1	0	2	2	0	1	0	0	1	0	0	1	0
34	rathnamma	3	1	0	3	1	0	2	1	0	3	1	0	2	1	0	2	2	0	2	1	0	2	1	0	2	1	0	2	2
35	lalitha	2	2	0	2	2	0	2	0	0	1	0	0	1	0	0	2	2	0	1	1	0	0	0	0	0	0	0	0	0
36	sarasamma	2	2	1	2	2	0	1	0	1	0	0	0	0	0	0	2	2	1	1	0	0	0	0	1	0	1	1	0	1
37	sudha	1	1	1	2	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	1	2	3	0	0	3	1	0	1
38	anandhavalli	1	2	0	1	2	0	2	2	1	2	2	0	2	2	0	2	2	0	2	2	0	2	3	0	2	2	0	2	3
39	jaya	2	2	0	2	2	0	1	1	0	0	1	0	0	1	0	2	2	0	0	1	0	0	1	0	0	1	0	0	1
40	jagadhamma	2	1	0	2	1	0	1	1	0	2	1	0	2	1	0	2	2	0	2	2	0	2	0	0	2	0	0	2	3

Shows the severity of dermatitis (based on severity grading scale) in the right hand and left hand over individual fingers

Abreviations: P - Palmar, D - Dorsal, N - Nail

Table 5

N
0
0
0
0
0
0
1
0
0
0
0
0
0
0
0
0
0
0
1
0
0
2
1
0
1
0
0

Shows the severity of dermatitis (based on severity grading scale) in the right hand and left hand over individual fingers
Abreviations: P - Palmar, D - Dorsal, N - Nail

Table 5

0
0
0
0
0
0
0
0
0
0
0
0
0

Shows the severity of dermatitis (based on severity grading scale) in the right hand and left hand over individual fingers
Abreviations: P - Palmar, D - Dorsal, N - Nail

	Workers			Right Hand				
		Grading	0	1	2	3	4	
1	SANTHA	D	P					
2	THANKAMANI	D				P		
3	AMBUJAKSHI	D	P					
4	RAJAMMA	D	P					
5	RATHNAMMA	D	P					
6	REMANI	D	P					
7	PADMAVATHY	D	P					
8	VASANTHI	D	P					
9	MAHILAMANI	D	P					
10	KOMALAVALLI	D	P					
11	YAMUNA	D	P					
12	SRIDEVI	D	P					
13	REMANI	D	P					
14	PONNAMMA	D	P					
15	SANTHAMMA	D	P					
16	RADHA	D	P					
17	GIRIJA	D	P					
18	VAVACHI	P	D					
19	RAJAMANI	D	P					
20	LEKSHMI	D	P					
21	NAGAMMA	D	P					
22	SUMATHI	D		P				
23	LATHA	D	P					
24	SINDHU	D	P					
25	SAVITHRI	D	P					
26	REMA	D	P					
27	SARASAMMA	D	P					
28	ANANDHAM	D		P				
29	BINDHU	D	P					
30	AMBIKA	D	P					
31	SUMATHI	D	P					
32	VILASINI	D	P					
33	SANTHA	D	P					
34	RETHNAMMA	D	P					
35	LALITHA	D	P					
36	SARASAMMA	D	P					
37	SUDHA	D	P					
38	ANANDHAVALLI	D	P					
39	JAYA	D	P					
40	JAGADAMMA	D	P					

Left Hand

	0	1	2	3	4
D	P				
D			P		
D	P				
D	P				
D	P				
D	P				
D	P				
D			P		
D	P				
D	P				
D	P				
D		P			
D	P				
D	P				
D		P			
D	P				
D	P				
P	D				
D	P				
D	P				
D		P			
D	P				
D	P				
D	P				
D	P				
D	P				
D	P				
D		P			
D	P				
D	P				
D	P				
D	P				
D	P				
D	P

TABLE 7 - STATISTICAL ANALYSIS

FINGERS	Test (T = 1) Users		Control (C=0) Non Users		t	p
	Mean	SD	Mean	SD		
Right Thumb	1.93	0.59	2.06	0.25	0.79	0.431 NS
Left Thumb	2.13	0.63	2.25	0.44	0.59	0.559 NS
Right Index	1.66	0.61	2.00	0.00	2.16	0.039 **<0.05**
Left Index	1.53	0.63	1.93	0.57	1.85	0.074 NS
Right Middle	1.00	0.53	1.87	0.34	5.46	0.000 **<0.05**
Left Middle	1.00	0.65	1.93	0.7	4.24	0.000 **<0.05**
Right Ring	0.60	0.63	1.93	0.44	6.85	0.000 **<0.05**
Left Ring	0.46	0.51	1.87	0.80	5.74	0.000 **<0.05**
Right Little	0.86	0.74	1.75	0.44	4.04	0.000 **<0.05**
Left Little	0.88	0.86	1.75	0.57	3.62	0.001 **<0.05**

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PRO FORMA

Date :

Name :

Age :

ID No. :

Duration of Work :

Address :

Dermatitis :

Hand	Rt.					Lt.				
	0	1	2	3	4	0	1	2	3	4
Palm										
Dorsa										

Fingers	Rt.					Lt.				
	Thumb	Index	Middle	Ring	Little	Thumb	Index	Middle	Ring	Little
Palmar aspect										
Dorsal aspect										
Nail involvement										

Description

Involvement of other sites	Rt.	Lt.
Dermoglyphics		
Forearm		
Feet		

Chest	
Face	

CONSENT FORM

Name : Date :

Address :

I, _____ have been fully informed about the aims and objectives of this study titled **“Study the Pattern of dermatoses among workers in Cashew nut industry and to assess the protective efficacy of rubber finger glove as a barrier in patients with dermatoses”.**

I understand that I will not get any benefit by subjecting myself to this study and that I have the right to withdraw from the study at any given point of time.

I agree to the fact that the medical knowledge obtained from this study can be put into use in the future.

Sign :

Name :

Date :